FEBRUARY 24, 1958 PRICE 50 CENTS

Product Engineering

RESEARCH and DEVELOPMENT news edition

McGRAW-HILL MAGAZINE OF DESIGN RESEARCH AND DEVELOPMENT

INDIVIDUAL INVENTION – a lost art? see page 32

SWEDISH DESIGNS

see page 34

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NEWS ITEM NO. 3 1958

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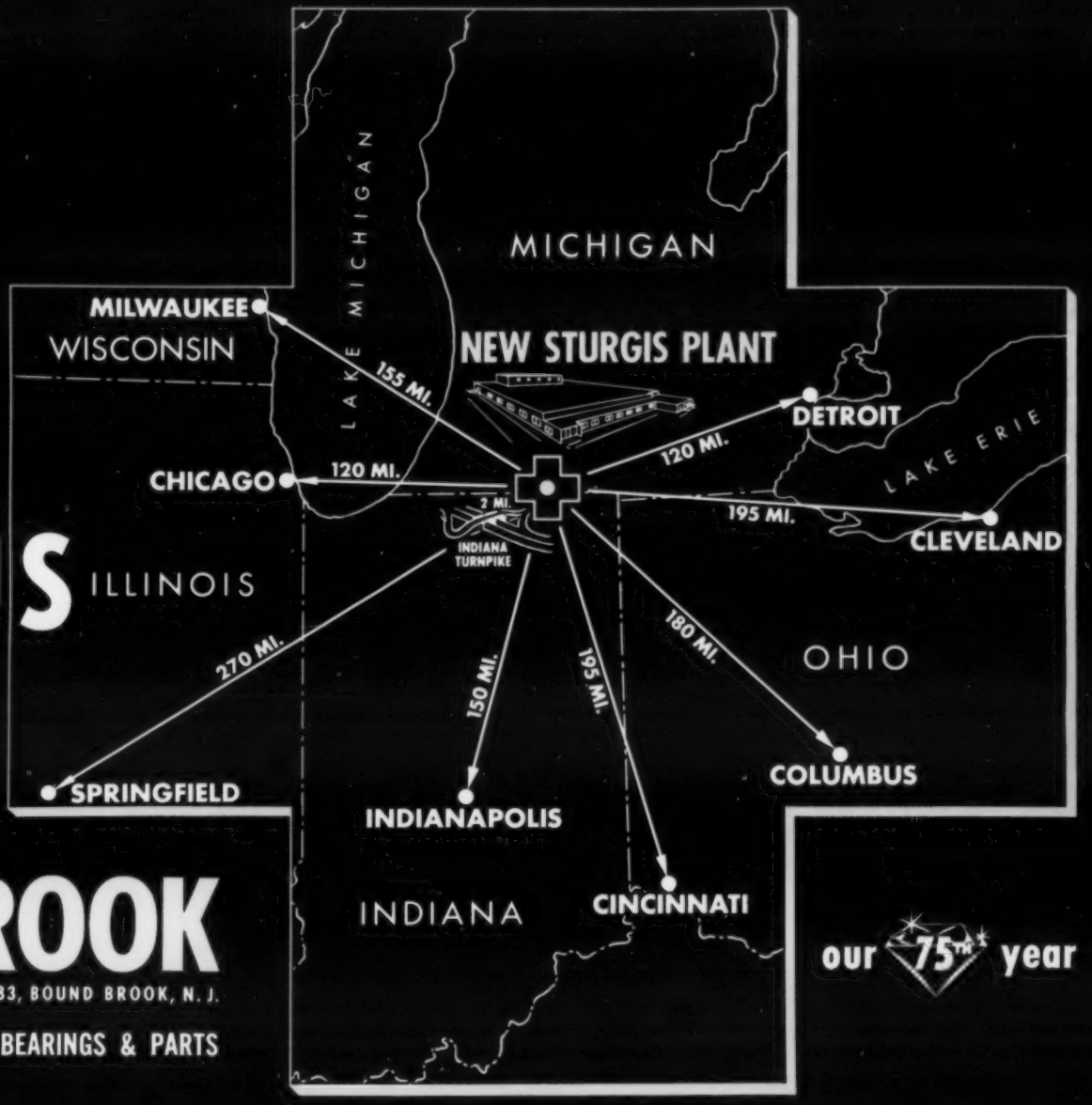

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R&D news edition:

- TRENDS in appearance design . . .
  Industrial design and styling ideas in new products

- POINTS OF VIEW
  Opinions of representative engineers and others on controversial subjects of current interest.

- WHY
  DON'T THEY
  RESEARCH and DEVELOP . . .
  Possibilities for new products not now available

- *FYI (personal)*
  Products and ideas of personal interest to design engineers

- ***NEWS SURVEYS . . .***
  Studies in various design fields.
  Already published: machine tools, foreign engineering, opinion of US engineering, etc.

- SCIENTIFIC BOOKS
  Reviews of new literature broader than the design field itself

coming next week . . .

the DESIGN edition for March 3

FEATURING:

- **Nylon-clad sleeve bearings.**
  Tests show practical value of this new, moisture-resistant nylon.
- **Which finish for zinc die castings?**
  A guide to mechanical, chemical, plated and painted finishes.
- **Small induction motors.**
  Greatly improved designs are replacing series motors.
- **Controlled acceleration.**
  Six methods compared for starting high-inertia loads.
- **Linear programming can be easy.**
  Pencil, paper and simple arithmetic to solve "transportation" problems.
- **Fastener checklist.**
  A question-and-answer review for joint design and fastener selection.
- **Quick check for writing "Instructions".**
  A prefabricated outline to help do the job quickly and completely.

Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN, RESEARCH AND DEVELOPMENT

R and D RESEARCH and DEVELOPMENT news edition

February 24, 1958 Vol. 29, No. 8

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Product Engineering ..... SIDELIGHTS

Research and Development edition

● In his plea for the lone inventor (p. 32), Dr. Kroll hopefully presupposes that there are still men around who can stand being alone for long periods of time. This kind of individuality is fast disappearing from the American scene—and with hardly a ripple of comment. Even the current debate on educational problems rarely mentions the need of teaching children to think for themselves. As a reminder, note the definition of an educated man: one who can entertain himself, others, and a new idea.

● With all the hoopla about the *Explorer* (p. 23) most newspapers (except the Milwaukee *Sentinel*) overlooked one technical area in which we beat Russia cold. For years, the world's toothpaste manufacturers have been engaged in research of a most fundamental nature. Secret laboratories bristled with security regulations, scientists and engineers struggled with semifluid flow equations, and at last American engineers cracked the problem. Can you imagine Krushchev's jealous glare when he first squeezes out a strip of red-and-white striped toothpaste?

● Swedish design (p. 34) is simple, graceful, ingenious, and appropriate to its purpose. But why in Sweden? Yes, it's an industrial country, but so is England. It's not the weather either—Italy is having a similar renaissance with far more sun. Latest theory (unproved) is that the similarity between smorgasbord and antipasta has something to do with it. You start by designing a Lazy Susan and the next thing you know weirdly shaped telephones and typewriters are on the way.

● Lack of adequate high-school science is getting the blame for everything these days—even mismanaged robbery. We note the experience of hijackers who stole a trailer truck with 42,900 lb of coffee. They drove to an abandoned garage, backed in and unloaded without trouble. But when they tried to drive out, the lightened trailer was too tall—the truck ripped out the front of the garage and a falling steel beam pinioned it. The bandits got away with whole skins and nothing else.

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Bonds beyond the usual bounds

Bonding rubber to metal was long a bugaboo to both manufacturers and users of many molded rubber parts. But today, at Goodyear, it's a problem of the past.

Originally, production methods of obtaining adhesion centered around a very limited group of metals and rubber compounds. But, over the years, the molded rubber specialists of Goodyear perfected new techniques of bonding which opened entirely new fields for the use of rubber by design engineers.

Unmatched rubber-to-metal bonding is just one of the advantages of working with Goodyear on molded or extruded rubber goods. Other reasons are outstanding product design assistance, rubber compounding, mold design and the latest in production methods and equipment plus the expert help of the G.T.M.—Goodyear Technical Man. For full details write to Goodyear, Industrial Products Division, St. Marys, Ohio, Los Angeles 54, California, or Akron 16, Ohio.

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GOODYEAR

THE GREATEST NAME IN RUBBER

READER TO EDITOR

Phone That Remembers

To the Editor:

In your "Why Don't They Research and Develop" *(Oct. 21, p. 54)*, somebody asked for a device that would indicate when a phone has rung during one's absence.

This company has developed an automatic device to do just this and the patent on it was just issued, No. 2,818,154. Basically it is a sound-operated alarm consisting of a make-and-break contact which actuates a neon light during the break. Because of the peculiarities of the neon light it stays on after the contact recloses. In order to make this device shock-proof, in the ordinary sense, a time delay is incorporated so that a continuous sound lasting one or two seconds is necessary before the neon light is actuated. We have built several models of this device and they can be incorporated in a small stand on which a telephone would normally rest.

Our company is not interested in manufacturing this but would prefer to license or sell the patent to someone else. We would appreciate hearing from anyone interested.

—J. Rabinow
President, Rabinow Engineering Co., Inc.

Water Costs

To the Editor:

We note with interest the article "U. S. Invests Heavily in Fresh Water" *(Oct. 7, p. 23)*. We are concerned, however, about the sea water conversion costs you report, since, we believe, they set forth an erroneous impression. The impression created is that the cost of making fresh water from sea water with a Cleaver-Brooks unit is much higher than either the W. L. Badger or the Hickman unit. This impression is incorrect. At the Joint Hearings before the U. S. Senate in 1951, we submitted figures of $1.21-M-gal for a diesel-driven vapor compression evaporator, and $1.12-M-gal for electric drive. We have no knowledge of the $1.85 figure you attributed to us.

It should be noted that the figures you report for the W. L. Badger and the Hickman units are "paper" figures. Neither of these units has yet been started on its sea water trial runs at Harbor Island. It will naturally be some time before any conclusions can be drawn as to whether these machines have any commercial possibilities. On the other hand, any figures supplied by us have been largely based on some hundreds of actual installations covering vapor compression and other types.

—F. A. Leobel
Vice President, Cleaver-Brooks Co.
Milwaukee, Wis.

Vive la 8-day Alarm

To the Editor:

In answer to "Why Don't They Research & Develop" *(Dec. 16, p. 54)*, I hasten to say for years I had a spring-wound 8-day alarm clock which rang only once a day, having a 24-hour setting dial. It was made by either the Sessions Clock Co. or the New Haven Clock Co. When it finally gave out and would run no more, I was indeed sorry that a replacement was not available.

It was a dandy timekeeper and never did fail because of power failure! I set it on Sunday evening and usually turned it off on Friday morning. It ran more than eight days on one winding and rang just so long whether or not I got up!

I am sure that you will hear from many others who had such a clock.

—Arthur H. Jenson
Milwaukee, Wis.

Two-timer

To the Editor:

I got a chuckle out of your note on an alarm clock with two ringing times *(Dec. 16, p. 54)*. Why? Because about 15 years ago I suggested this idea to GE Telechron Division—even giving them a trade name for it. I proposed to call an alarm clock, employing precisely the features you describe, the Telechron "Two-timer." But apparently GE is operated by single men—or else decisions are made by men who don't have to use alarm clocks. At any rate, the need for an alarm clock for married people still exists. Or perhaps, this idea is un-American because it would let one clock do the work of two, thus causing unemployment in the alarm-clock industry.

—Clarence W. Metcalf
Sharon, Mass.

Dashed Circles

To the Editor:

We enjoy *Product Engineering* and noticed in the Jan. 27 issue under "Why Don't They Research & Develop" an item we "did" some time ago as per enclosed picture. Prototype models worked quite well and are available together with our drawings and experience to an interested manufacturer.

—R. L. Weir
President, Weir Development Co., Inc.
Dayton 5, Ohio

• *Photo shows compass attachment for drawing dashed lines.—Ed.*

Built-in Vacuum

To the Editor:

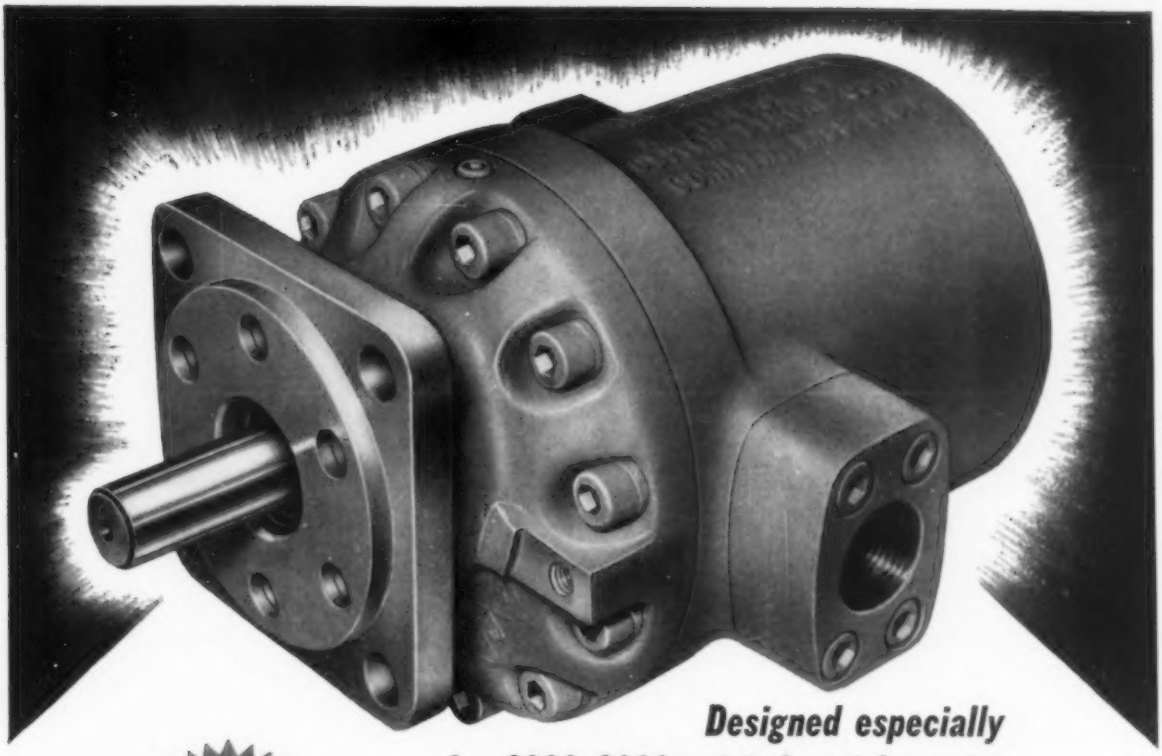
An item in your "Research and Develop" column of the Jan. 27 issue caught my eye.

Premier Company's central vacuum cleaning system is a similar low-cost ($275) unit that was introduced last year. The vacuum machine, because of its large capacity, requires emptying only a few times a year, and its remote location (basement, garage, etc.) means quiet operation.

Marketing of a system of the type suggested in your column could prove difficult, since the sanitary codes in cities throughout the nation vary widely and many of them prevent the depositing of dirt and similar substances in sewage systems. At least one company discontinued development of such a system for that reason.

—Gordon Hellekson
Kerker Peterson Hixon Hayes, Inc.
Minneapolis, Minn.

• *We are also grateful to Simplon Corp., Dearborn, Mich., for bringing its Easy Way Vacuum Cleaner to our attention. This unit features a hose that retracts into the wall.—Ed.*



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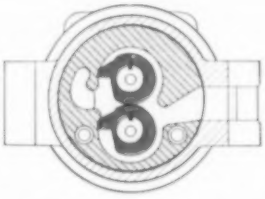


Schematic diagram above shows one of the two sets of pistons in the sturdy Berry Rotary Piston design.

CHARACTERISTICS
Models A-12 and A-12B

Drive Shaft Rotation	Reversible
Working Pressure	2000 psi
Surge Pressure	3000 psi

Operated as a Pump

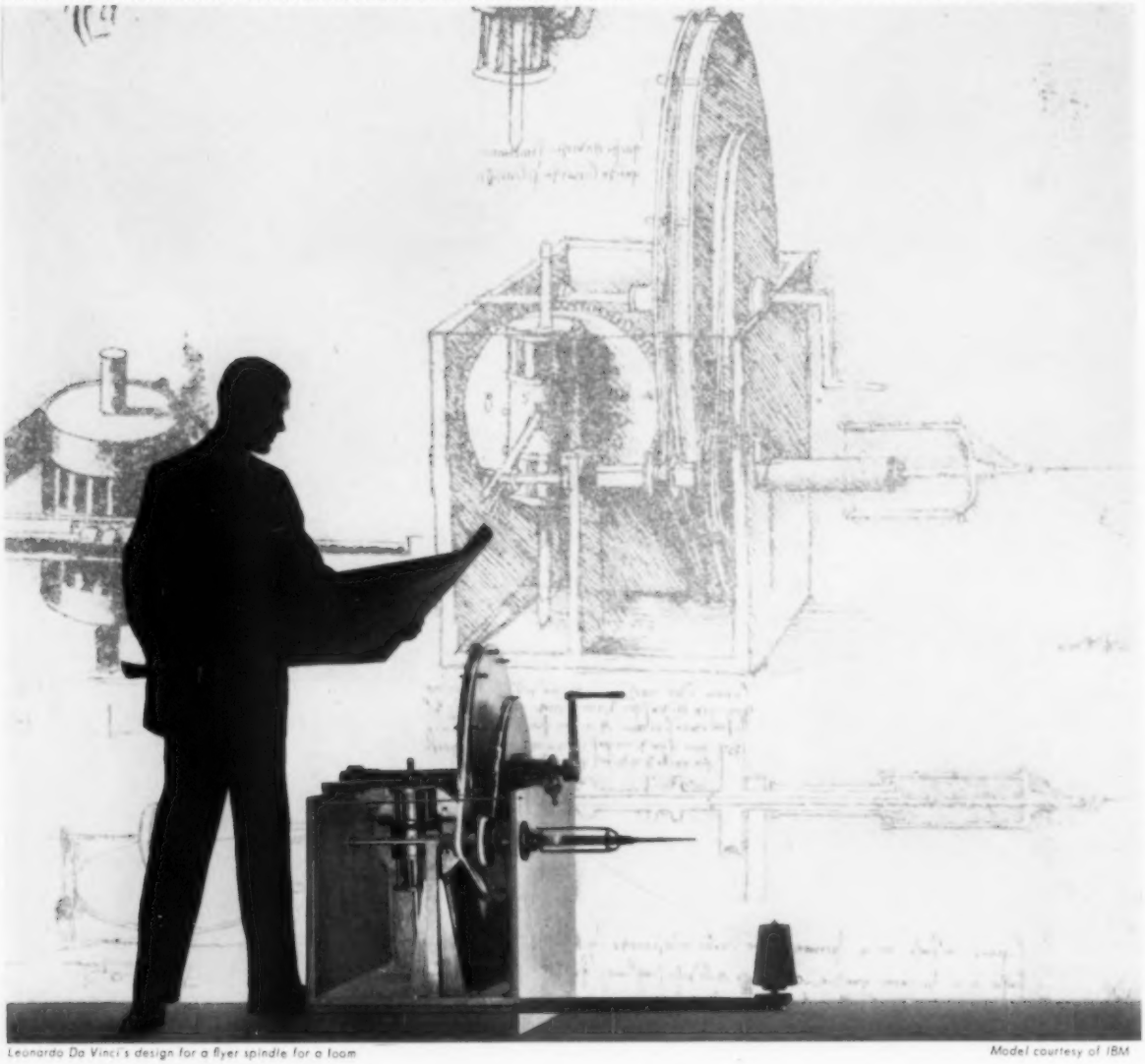
Drive Shaft Speed—Maximum	1200 rpm
Displacement	12 gpm*

**Capacities from 7.5 to 12 gpm at rated speed are also available.*

Operated as a Motor

Drive Shaft Speed—Maximum	1800 rpm
Displacement—CIR	2.356
Displacement—GPR	.0102
Theoretical Torque inch lbs./100 psi	37.4

creative designing calls for an open mind



Leonardo Da Vinci's design for a flyer spindle for a loom

Model courtesy of IBM

EVEN DA VINCI'S DESIGN COULD HAVE BEEN BETTER WITH HELP FROM AN SKF ENGINEER—An SKF engineer never has to push one bearing over another, because SKF makes all four types of ball and roller bearings in over 3,000 sizes. This gives every SKF engineer the kind of flexibility he needs to keep an open mind on any bearing problem. Give your problem to SKF and see.

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American...

DEVELOPMENTS TO WATCH...

Satellites don't have to ride piggyback . . .

. . . says Martin Summerfield of the U. of California. Maybe we're sticking too close to one design concept. The principle of multi-staging is that each rocket in a series provides a boost for the next one, the last carrying a payload. But, he told a special UC seminar on space technology, several variations from the standard arrangement are possible: "The engine of the second stage can be allowed to fire at the same time that the boosting first stage is started . . . or, the tank structure of the first stage might be jettisoned, while its engine might continue to operate with the second stage."

There is no disadvantage in trying different arrangements, he points out, because in any event, the stages of a multi-stage rocket must differ in specific impulse, thrust-to-full-weight ratio, dead-weight fraction and payload fraction. Experimentation could pay off handsomely.

Plastics from sugar . . .

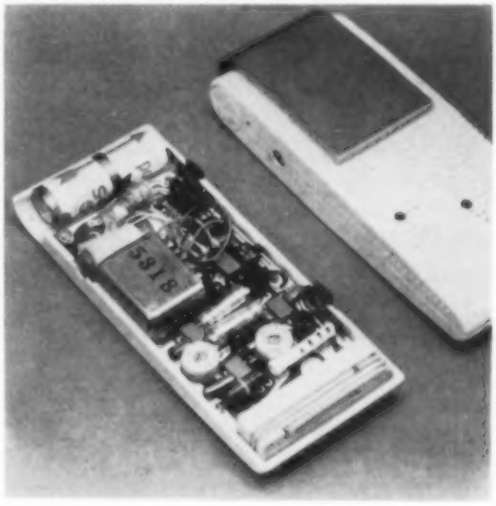
. . . are in the pilot stage. Using a formula and process developed by the Sugar Research Foundation, Valite Division of Valentine Sugars, Inc., now has a series of sugar-formaldehyde resins in the pilot-plant stage. Valite is not yet ready to supply application data, but does say they're pale amber resins that are being evaluated for the full range of applications from adhesive to molding compounds.

The long-sought goal of large-scale commercial applications for sugar-based compounds now seems in sight. Within the past few months, several chemical suppliers and sugar-producers have announced sugar-based compounds that show promise for plasticizers and cross-linking agents, surface-active agents, and germicides.

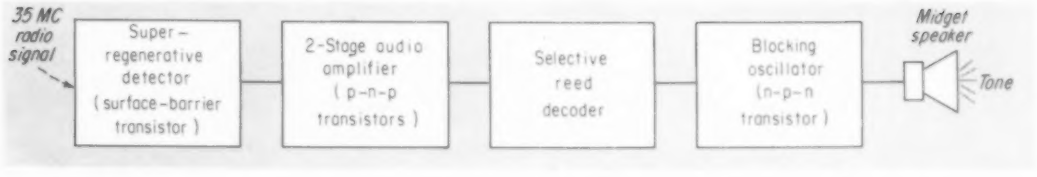
If they live up to expectations, sugar may soon become as important in chemical processing as it is to the consumer.

City-wide paging system . . .

. . . is going into service on a test basis in Allentown-Bethlehem, Pa., area, using Bell System facilities. Subscribers to the service carry the small portable receiver pictured here. A special "signalling-service operator," reached by dialing on any telephone, calls the person wanted by sending out a modulated RF signal that is picked up by the receiver, demodulated, and amplified to energize four highly selective vibrating reeds that respond only if energized in the proper sequence. These, in turn, trigger an audio oscillator, alerting the customer. He then telephones the service operator, (or any previously arranged number) to get his message.



Portable signal receiver weighs only 8 oz, uses 4-volt battery, three types of transistors (note block diagram).



American...

(continued)

DEVELOPMENTS TO WATCH...

Will silicon carbide be . . .

. . . the next important transistor material? It's known to have semiconducting properties and would offer "substantially higher" heat resistance than silicon metal, much higher than germanium. Problems have developed, though, in producing the material in the purity necessary for semiconductor applications, and in creating the junctions.

A lot of work is being done with silicon carbide, at laboratories like the Air Force Cambridge Research Center, and at several industrial plants, and there have been some very optimistic statements. But most engineers feel the commercial debut of silicon-carbide transistors still is some distance away.

Silicon-carbide rectifiers have been built by several laboratories and have operated successfully at temperatures as high as 1200 F—far above the top operating temperature for silicon metal and germanium. But making transistors is a tougher problem. The zone-refining technique, for example, that has been so successful with germanium and silicon can not be applied to silicon carbide.

Raytheon Manufacturing Co., one of those actively engaged in silicon-carbide research, hopes to use the material in its new spacistors (*PE—Sept. 9, '57, p. 16*) as well as in transistors, and says:

"We are developing novel means of producing semiconductor-grade silicon carbide. While we have had some success in this area, we are still not completely satisfied. . . . It is, at present, difficult to obtain silicon carbide with high carrier mobility and lifetime." Raytheon is, therefore, continuing its work, but making no promises.

Salt-water conversion still . . .

. . . using centrifugal compression system is being designed by Aquastills, Inc., Rochester, N. Y. Company hopes soon to market it for household use in water-short areas. (For information on salt-water conversion problems, and other approaches to their solution, see *PE—Oct. 7, '57, p. 23*).

Strange optical effect . . .

. . . demonstrated by Dr. E. H. Land of Polaroid Corp. may pave the way for new photographic and display techniques. He showed a National Academy of Science meeting how mixtures of red and white light can stimulate the sensation of a range of colors. Projecting a red-filtered black-and-white image in red light and a green-filtered black-and-white image in white light, he produced a combined image that looked not pink, but multicolored. No direct application for the phenomenon has been found, but Dr. Land believes it rates further study. One possible explanation: Human beings have an atavistic binary color reception system, a relic of earlier stages in evolution, which has previously escaped notice.

Specialty lubricants . . .

. . . are now being promoted for home as well as industrial use. Instead of "one oil for every purpose," lubricant-makers are now bringing out specialty packages like the one pictured here, combining light oil, heavy oil, and no-stick grease. It could be helpful if consumers use the right grease on the right part—but they could also create plenty of havoc by using the wrong grease. Product planners might well want to re-examine their own specifications and instruction sheets in the light of this new trend. —ARG

New lubricant package for consumer use has white oil, "slick lube," and graphited oil packaged in Bracon nozzle-tip polyethylene squeeze tubes.

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ONE COIN

is just like another of its kind — miniature precision on a magnificent scale. U. S. A. money is beautiful, durable.

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MPB

MINIATURE PRECISION BEARINGS

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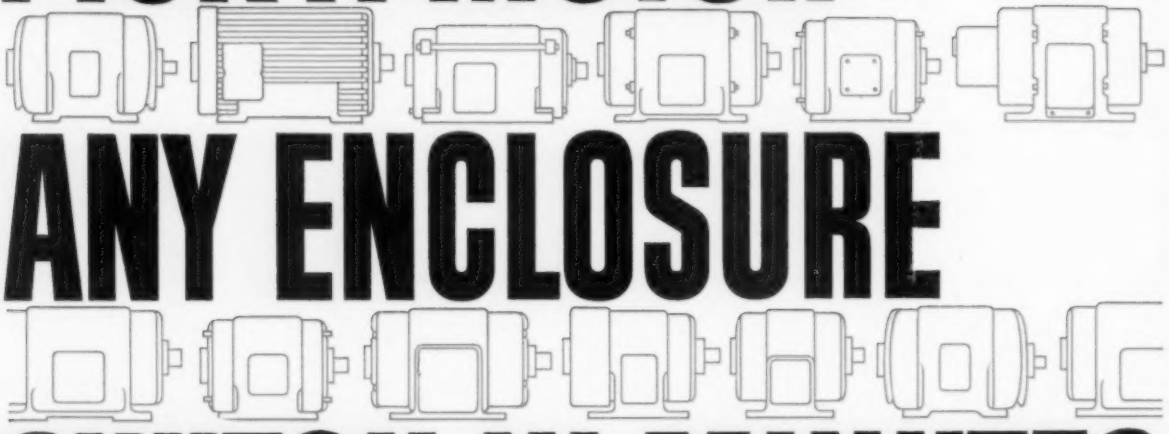
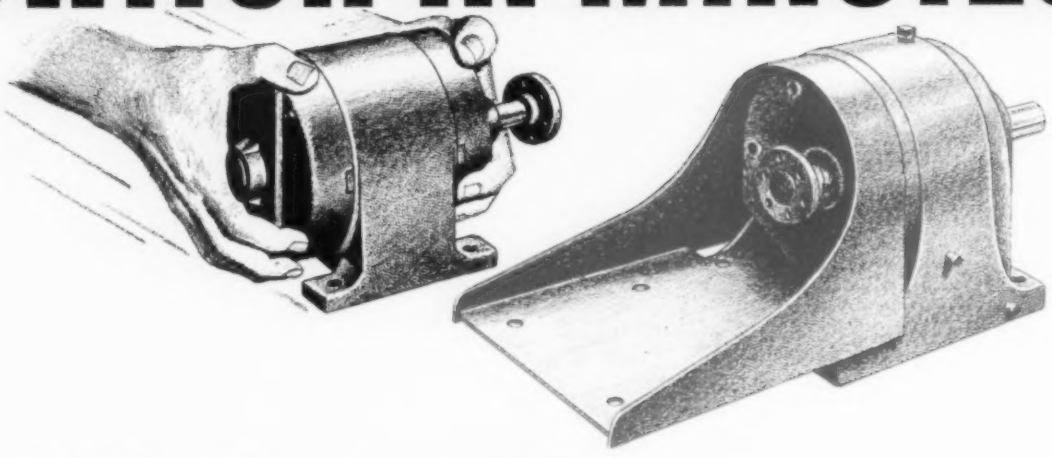
PICK A MOTOR ANY ENCLOSURE SWITCH IN MINUTES





DESIGNED for bracket-mounting foot-type motors of *any* manufacturer, Link-Belt Motogears radically slash delays in making motor replacements. Remove four bolts, disengage the coupling, re-assemble with another motor —and it's ready for work. No need to drain oil. And no re-alignment problems — the bracket assures accurate positioning of the motor.

Link-Belt Motogears are immediately available from nearby stocks, in sizes to 100 hp, output speeds from 280 down to 1.8 rpm. Call your nearby Link-Belt office for complete information.

ASK FOR BOOK 2447 — contains features and data on Link-Belt Motogears. Also covers Gearmotors — with flange-mounted NEMA motors—and Electrofluid Motogears with *"Cushion Action."*

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American ...Washington

DEVELOPMENTS TO WATCH...

Exploration into outer space . . .

. . . has created a problem that is developing into a tug of war. Top military officers want to keep control in the Pentagon. Congressmen—both Democratic and Republican—however, are not so sure about this. Special committees have been set up to study the merits of creating a new non-military agency, perhaps patterned after the Atomic Energy Commission, to handle the job. June 1st is the date set for the committees to prepare legislation on the matter.

The President is having his special adviser for science and technology, Dr. James R. Killian, prepare recommendations too. These will be the basis for the administration's stand.

The basic problem is that scientists—and many congressmen—are afraid that, if space exploration is left entirely under military control, purely scientific advancement will suffer. At the outset, Congress seems to lean toward keeping top authority on space outside the Pentagon.

There are politics in the issue. Top Republicans and Democrats are anxious to be credited with the master minding done in this field.

For the time being, Sec. of Defense McElroy has authorization to administer all outer space projects. These will be handled under the new advanced research projects agency. Roy W. Johnson, formerly a vice president with General Electric, has been named to head the new office. Johnson's success in handling this job could well have great bearing on how much of space the Pentagon is able to win from Congress for itself.

Sodium-cooled reactors . . .

. . . for the Navy's nuclear powered fleet have been finally ruled out. Navy tried one in its second atom powered submarine the Seawolf, but it ended up with nothing but troubles.

Now Navy has asked Congress for $20-million to pull out the sodium reactor and install a pressurized water system similar to that in the Nautilus.

Initially, sodium reactors were held out to be potentially better than the pressurized water types. Reason is they produce the more efficient high water temperatures with a low pressure pumping system. The Seawolf's pumping power was only ¼ that of the Nautilus.

But, Navy soon found out that sodium had bigger drawbacks. Basically, sodium is more dangerous. It is 30 times as radioactive as a pressurized water system. In addition, sodium's strong corrosive characteristics produced leaks that couldn't be controlled. Leaks in the system were hard to find, too. When Navy ran its Seawolf up to full power at dock trials, the system sprung a leak that took three months to locate, and when found was never fully fixed. Eventually, Navy had to seal off one of the superheaters and operate the submarine at about 80% of its rated capacity.

While this might be the end of the Navy's experiments, it doesn't necessarily write off sodium for land based plants, however.

How to keep track of technical information . . .

. . . With new systems used by top companies and government agencies, is now available in a free report from the National Science Foundation, Washington 25, D. C.

The report consists of 25 descriptions of technical information systems, currently in operation, embodying new principles for the organization of subject matter or employing automatic equipment for storage and search.

Broadly, the systems reviewed fall into four main categories: manual systems employing aspect cards—one card per indexing term such as uniterm of "peek-a-boo" systems; mechanical systems using aspect cards such as coordinated indexing systems used with punched-card equipment or computers; manual systems using item cards—one card per item, such as keysort systems; and mechanical systems using item cards such as Zator systems, indexing systems used with punched-card equipment or computers.

Descriptions include equipment and manpower used, size of organization served, and the size and growth of the file.

World-wide ...

DEVELOPMENTS TO WATCH...

A high-temperature titanium alloy . . .

. . . that shows "great promise for applications in the 700-to-800-F range" is being developed by Imperial Chemical Industries for jet-engine parts and similar applications. It's an 85% titanium alloy, with 12.5% tin and about 2.5% aluminum.

ICI's first alloy of this basic composition was introduced commercially about a year ago, but then withdrawn because it was not entirely stable. Now, ICI is modifying the composition and believes that, within the year, it will have the problem licked.

Meanwhile, the Tin Research Institute is also conducting tests—these aimed at developing a powder metallurgy technique that might get around the difficulties in melting and casting the alloy (the methods so far used by ICI). The troubles stem from titanium's high reactivity in the molten state, and are common to almost all titanium alloys. A powder method might have several advantages. Recent research on aluminum alloys (*PE*—Dec. 16, '57, p. 12), indicates sintered parts may show considerably greater heat resistance than the cast metal and also higher strength (see item below).

Recording galvanometer . . .

. . . that uses ultraviolet light as its recording mechanism has been developed by New Electronic Products, Cavendish Street, London. According to the company, a mirror mounted on the galvanometer reflects radiations from a mercury vapor lamp on to U-V sensitive recording paper. The record is "developed" simply by exposing the paper to daylight, the company says, and it is permanent if the paper is not left in the daylight too long. The trace will become visible in less than 10 sec, and a trace velocity as high as 10,000 in. per sec is said to be possible. Paper speeds range from 0.2 to 6 in. per sec.

Nylon and vinyl-fiber paper . . .

. . . will be produced commercially in Japan by a new "wet" process that's said to make it superior to paper not only in strength and fire resistance, but also in smoothness (most synthetic-fiber papers so far produced in this country have strength and fire resistance, but do not equal ordinary paper in texture and appearance). Prof. Seizo Okamura of Kyoto U., who developed the new manufacturing process, believes the paper will prove especially useful for filtration, wrapping for long-term storage of parts, and for maps and might even be used for "paper" money.

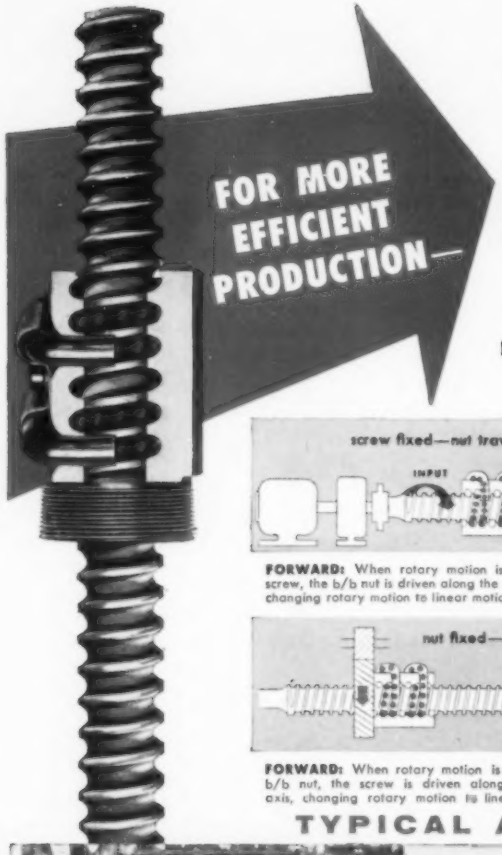
The Special Paper Manufacturing Co., Shizuoka Prefecture, will make the nylon paper, Hirose Paper Mill, Kochi Prefecture, the vinyl material. Neither firm expects the new papers to be cheap. Probable price is about four times that of regular paper.

Sintered aluminum bearings . . .

. . . with improved performance characteristics are produced by a new process on which Metallgesellschaft AG, Frankfurt, Germany, has just obtained a preliminary patent. The sintered parts combine aluminum powder with intermetallic compounds (iron-aluminum, magnesium-zinc, magnesium-silicon, copper-aluminum, and the like) as well as tin and lead. Intermetallic additions are in the 5 to 10% range.

In-the-ear radio . . .

. . . developed by two German engineers, is a truly "wireless" unit. As the photo shows, it's only a little bigger than a flashlight bulb, operates on transistors. Its inventors make no claims about power or tonal quality, have not yet announced plans for manufacture—but they do say it will work.

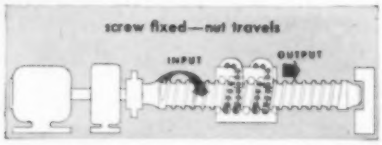


FOR MORE EFFICIENT PRODUCTION—

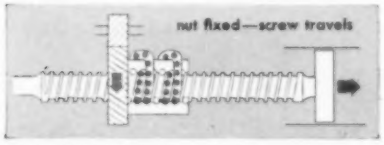
ACTUATE OR POSITION IT BETTER WITH

SAGINAW b/b SCREWS

6 decisive advantages reduce manufacturing problems and costs:



FORWARD: When rotary motion is applied to the screw, the b/b nut is driven along the axis of the screw, changing rotary motion to linear motion.



FORWARD: When rotary motion is applied to the b/b nut, the screw is driven along its longitudinal axis, changing rotary motion to linear motion.

1 **POWER SAVINGS.** Operating with over 90% efficiency, Saginaw b/b Screws permit much smaller motors with far less drain on electrical systems, and also simplify circuitry.

2 **SPACE SAVINGS.** Saginaw b/b Screws themselves are compact. They permit smaller motors and gear boxes and eliminate auxiliary equipment required by hydraulics.

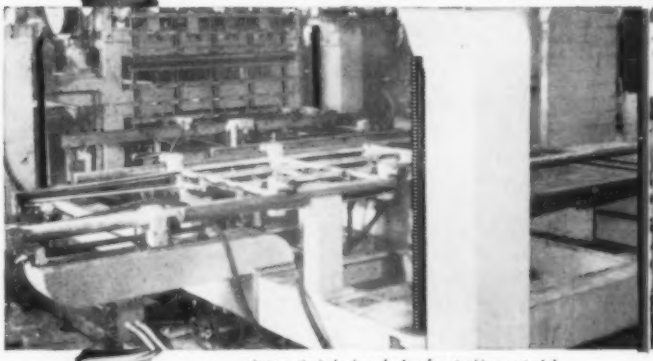
3 **DEPENDABLE PERFORMANCE.** Saginaw b/b Screws are far more reliable than hydraulics or pneumatics. Gothic-arch grooves, yoke deflectors and multiple circuits provide added assurance.

4 **PRECISE POSITIONING.** Saginaw b/b Screws will position components far more precisely than hydraulics or pneumatics; tolerances on position are held within .0006 in./ft. of travel.

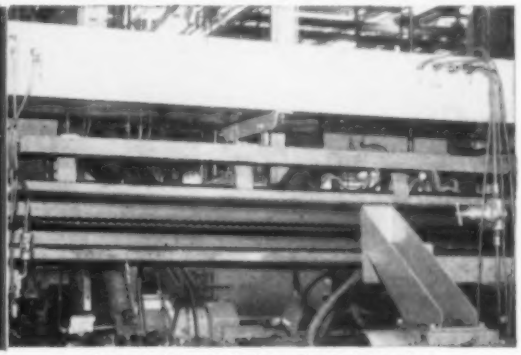
5 **TEMPERATURE TOLERANCE.** Normal operating temperature for Saginaw b/b Screws is from −75°F. to +275°F. But in selected materials, they will function efficiently at temperatures as high as +900°F.

6 **LUBRICATION.** If lubrication fails the Saginaw b/b Screw will still function with remarkable efficiency. Units have been built and qualified for operation without lubrication.

TYPICAL AUTOMATION APPLICATIONS



Automatic indexing device for stacking material. Saginaw b/b Screw used to raise and lower table.



Automatic device for loading and unloading machine. Saginaw b/b Screw used to save power and space.

If you would like further details on the use of Saginaw b/b Screws to increase the efficiency of plant operations, or specific application recommendations for your individual processes, experienced Saginaw engineers are at your service without obligation. Just write or phone us your requirements, or fill in and mail the handy coupon below.

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What's happening in SCIENCE

How many new fuels?

If you've been wondering how the "chemical bomber" is related to the "nuclear plane," or "photon propulsion" to the "plasma jet," you're in good company. Even the National Bureau of Standards hasn't yet classified the myriad propulsion systems now under discussion.

Nevertheless, there are a few guideposts to help keep you from getting lost in the wide blue yonder.

First, as to the "chemical bomber"; obviously, any fuel that releases energy through chemical action must be a chemical fuel. That certainly would include the standard petroleum fuels. But, as D. O. Myatt of Atlantic Research Corp. points out, the term "chemical" fuel is now generally reserved for *those fuels which obtain a significant fraction of their thermodynamic energy from the combustion of other-than-hydrocarbon compounds.* So "chemical fuels" include the new boron compounds, molecular hydrogen, metal particles, and most of the other solid and liquid propellants.

A second new group of fuels might be *those which obtain their energy from unstable or dissociated atoms and molecules.* In this class would fall ion propulsion (photo) which would operate through direct discharge of highly ionized particles; plasma systems which would take advantage of electrical energy contained in atomic fragments; and free radical propulsion, in which molecular fragments, perhaps held at very low temperature, would be made to give up energy as they recombined under the influence of heat. None of these has yet taken to the air; but all are under active study by industry, Government and university research groups.

For any of these fuels, either a nuclear reactor or a solar collector might be used to supply the necessary heat and auxiliary electrical energy. Thus, the "nuclear bomber" could be a plasma system, a free radical system, or perhaps a source of heat for combustion of one of the liquid fuels. These two systems, then, do not form a separate class, but cut across classes.

Finally, there are several systems still very much in the dream stage of which "photon propulsion" is perhaps most frequently discussed. This would, in some way, put to work the energy contained in quanta of solar light (as opposed to solar heat).

Semiconductors for infrared detectors

New infrared devices, based on the fact that semiconductors are transparent to short-wave light rays though opaque to visible light, are predicted by Dr. H. Y. Fan of Purdue University.

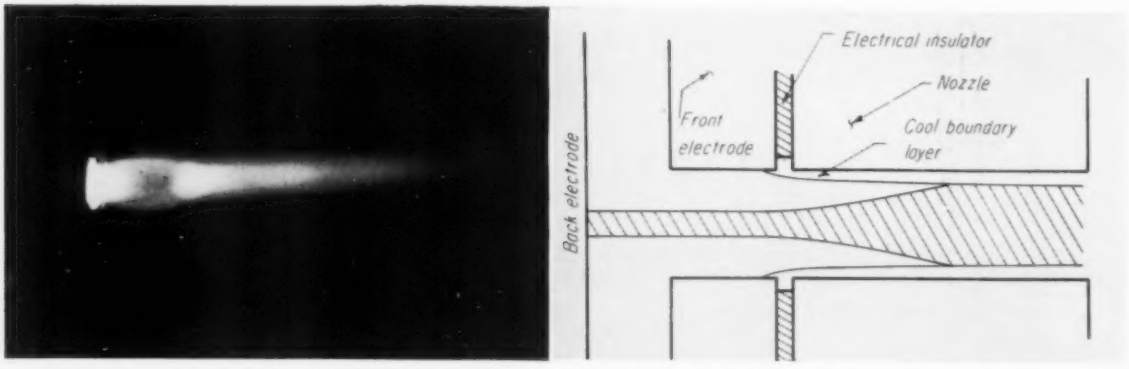
He notes that semiconductors react to light of various wavelengths in much the same way as to electrical impulses. Not until the temperature is raised do enough electrons of the semiconductor atoms jump from the filled band into the empty band to conduct electricity. In other words, it takes relatively little energy to get the free electrons of an impurity to carry current; but a good deal to excite the semiconductor atoms.

Similarly, semiconductors reflect or absorb high-energy rays in the visible region; letting low-energy infrared rays go through unscathed.

Work on the basic fundamentals of semiconduction is continuing at Purdue, with special emphasis on optical and electrical properties of semiconductors exposed to electron and neutron bombardment, high and low temperatures, and extreme pressures.

in brief . . .

How big is a neutron? Physicists at Stanford University say it's a cottony cloud of mesons with a radius of 8 x 10^{-13} cm. This, its magnetic size equivalent, turns out to be practically that of the proton. The researchers say this is surprising because the neutron's electrical or "charge" size is considerably less than that of the proton. Apparently, neutron magnetism is spread out over a larger area than its charge; while the proton's magnetic area approximately equals its charge area. A paradox, Stanford admits—and hopes further research will explain it. —ARG

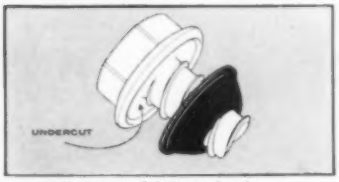


Ion propulsion moves a step closer with announcement by Giannini Research Laboratory that it has obtained specific impulses as high as 600 per sec (nearly twice that of most chemical rockets), and expects soon to reach 1,000. Photo shows plasma jet of ionized helium at temperature above 10,000 K, and standing shock waves. Diagram shows nozzle construction.

News about NEOPRENE

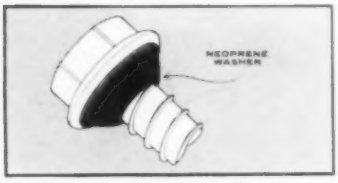
NEOPRENE washers are integral part of leakproof, cushioned fastener

A combination of an undercut head design and a conically shaped neoprene washer gives special advantages to these fasteners.



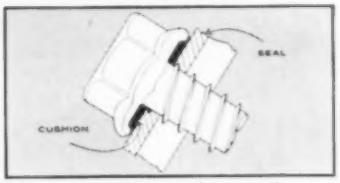
Undercut of fastener head . . .

The washer cushions the head and prevents metal-to-metal contact. Finishes are protected; transmission of vibration noise and squeaks is reduced.



. . . confines and controls flow of conical neoprene washer

As the fastener is secured, the undercut head confines and controls the spread of the resilient neoprene washer, which, in turn, flows into the top threads and seals the fastener hole.



. . . so washer seals the hole and cushions the fastener head.

It's another example of good design made possible with a part made of neoprene—the Du Pont synthetic rubber that is used throughout the automotive industry for resistance to oil, ozone and weather. Just clip the coupon for more information.

Lineman's blankets of HYPALON® take 15,000-volt shock for 147 test hours without damage

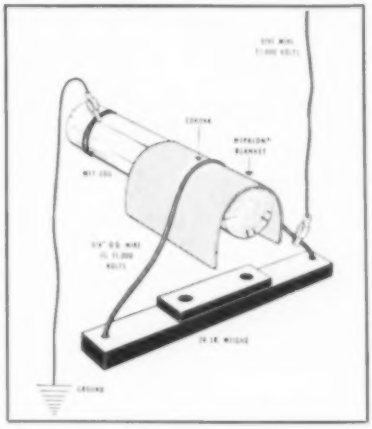
HYPALON retained full insulating value in test that burned through ordinary rubber in 12 minutes

Telephone poles often carry power lines in addition to telephone wires. When a pole needs replacement, telephone linemen usually do the job if power line voltage doesn't exceed 15,000 volts. In jockeying a new pole into position it may brush against the power wires. If the pole is wet it is conductive enough to be dangerous. Wet or not, linemen protect themselves against possible electrocution by wrapping the top of the pole with insulating rubber blankets.

Natural rubber blankets have high insulating value, but are vulnerable to corona cutting and deterioration from sunlight and weather. At the first sign of a cut or burn they must be discarded.

The extraordinary resistance of HYPALON synthetic rubber to ozone, sunlight and other oxidizing agents suggested its use for linemen's blankets to engineers at Bell Telephone Laboratories in Murray Hill, N. J.

Test blanket of HYPALON showed no damage after 15,000-volt test simulating actual service conditions. Test was discontinued after 147 hours.



Bell engineers devised a test closely simulating actual service conditions (see sketch). They soaked a pole stub in water, grounded it, draped a blanket over it, pressed a ¼-in. copper conductor against the blanket and applied 15,000 volts. Resultant arcing produced constant corona and evolved strong ozone. Ordinary rubber blankets failed quickly . . . some in 12 minutes. But a blanket of 100% HYPALON withstood 147 test hours with no corona cuts, ozone cracks or burn-throughs. Longer testing was considered unnecessary.

Performance like this makes HYPALON an excellent choice for parts or products subject to ozone, corona or strong oxidizing conditions. Mail the coupon for details on how this Du Pont synthetic rubber can help you in designing new products and improving old ones.

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Tough new organosol coating sprays unique textured finish

Bronze plating duplicates eye-appeal of 24K gold finish

A copper-tin plate with the rich, brilliant appearance of 24K gold is easily obtained from the unique M&T Bronze plating process.

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This most attractive decorative plate offers excellent corrosion protection for the product. Coated with a clear lacquer, it provides a high quality finish with long life as well as unusual appeal. It lends itself to distinctive accent applications, or to a uniform overall finish even on parts with complicated shapes.

M&T Bronze deposits as an 88% copper – 12% tin alloy. It covers recessed areas uniformly. Since the process is as easy to control and operate as processes depositing a single metal, designers can specify it in full confidence of consistent results. Send for more data.

Die cast trophies formerly plated with copper, nickel and gold now get equally handsome gold-like M&T Bronze.

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Outwears textured baked enamels by 10 to 1

Metal & Thermit presents UNICHROME COATING 6400, latest addition to a comprehensive line of vinyl dispersion finishes. This coating offers two advantages that set it apart as an extraordinary finish for quality products such as business machines, office furniture and similar items.

(1) It has an interesting and rich texture akin to high cost grained leather. (2) It has been endowed with properties that enable a COATING 6400 finish to retain its eye appeal long after lesser finishes have deteriorated or failed.

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A new type of organosol formulation, COATING 6400 has the well known chemical resistance of vinyl coatings to acids, alkalies, moisture, salt solutions and other causes of finish failure and corrosion.

It is a hard yet flexible coating . . . surpassing normal textured enamels in resistance to handling and abusive service conditions by as much as 10 to 1. *Applied by spraying*, it builds films of 8 to 40 mils, depending on the number of coats. COATING 6400 sticks tight to properly primed metals, will not chip upon impact.

Other features: Excellent electrical insulating qualities; gloss which can be varied from high to matte; wide selection of colors.

Write Metal & Thermit for detailed information on UNICHROME COATING 6400.

Unichrome is a trademark of Metal & Thermit Corp.

What's happening in MATERIALS

Stretchable paper ready for jobs

Paper that is "almost four times as tough" as ordinary sheet, that can be given any degree of elasticity from 2% to 15%, and that is softer to the hand than comparable materials, is now rolling off West Virginia Pulp & Paper production line.

Called Clupak, it was developed by Cluett-Peabody's Sanford Cluett. However, as pointed out in *PE*'s original disclosure (*Jan.* 6, p. 34), it is not a "Sanforizing" process—but almost the reverse. It involves changing orientation of the paper fibers, and mechanical compression during which some chemical bonding takes place. The fibers then resist being pulled apart to a much greater degree than do those of ordinary paper, and this is said to give "Clupak" its extra toughness.

At present Clupak, Inc. (the name of the joint CP-Westvaco enterprise), is producing several grades of kraft—asphalted and plain—on a new $25 million paper machine that can turn out 225 tons daily of sheet up to 20 ft wide. It also plans to license other paper makers.

The new papers (several types can be made) will probably cost 10 to 15% more than ordinary sheet; but Westvaco executives point out increased toughness should permit use of lighter grades—20% lighter in some cases.

Predicted applications, in addition to bags, containers and construction materials, range from cable-wrapping and tire-wrapping to auto fender pads, masking tape, gummed labels and shotgun shells.

Critical metals no longer "critical"

We may be running out of metals on a long-term basis; but we seem to have just about enough of everything right now. That's the obvious conclusion from Washington's latest stockpile report on strategic and critical materials. Of 74 items on the list, 51 fall in the "metals and minerals" category. Of these, "inventories substantially equal or exceed present long-term objectives" on 18; and "substantially equal or exceed present minimum objectives" on 49. Only Amosite asbestos and muscovite mica remain on the top priority list.

Columbium supply, for instance, is "adequate for all industrial uses, with production facilities not fully utilized." Selenium supplies are up, and demand down. Tungsten inventory is "in excess of mobilization requirements." And so it goes.

This doesn't mean that all objectives have been fully met, but does mean that minimum objectives have been reached, and product designers can breathe easier.

Molding method to cut parts cost

Savings up to 25% on molded plastics parts can be achieved with "valve gating," says W. R. Grace & Company's Polymer Chemicals Div. The method, to which Grace now has exclusive license, involves a variation of the standard injection-molding technique. Instead of being fed slowly, the molten plastic is held in the reservoir until it builds up enough pressure to release a valve and "gush into the cavity at high velocity."

Multiple valve-gates can be used. Grace says this "permits molding of larger and deeper pieces with considerably smaller machines."

Grace says the method can be applied to almost any thermoplastic.

Grace will not mold parts, but supply blueprints to guide mold adaptation, and molding know-how.

Valve gate molding is designed to reduce part shrinkage, speed molding cycle, and cut molding costs on thermoplastic parts, particularly large ones like this.

briefs . . .

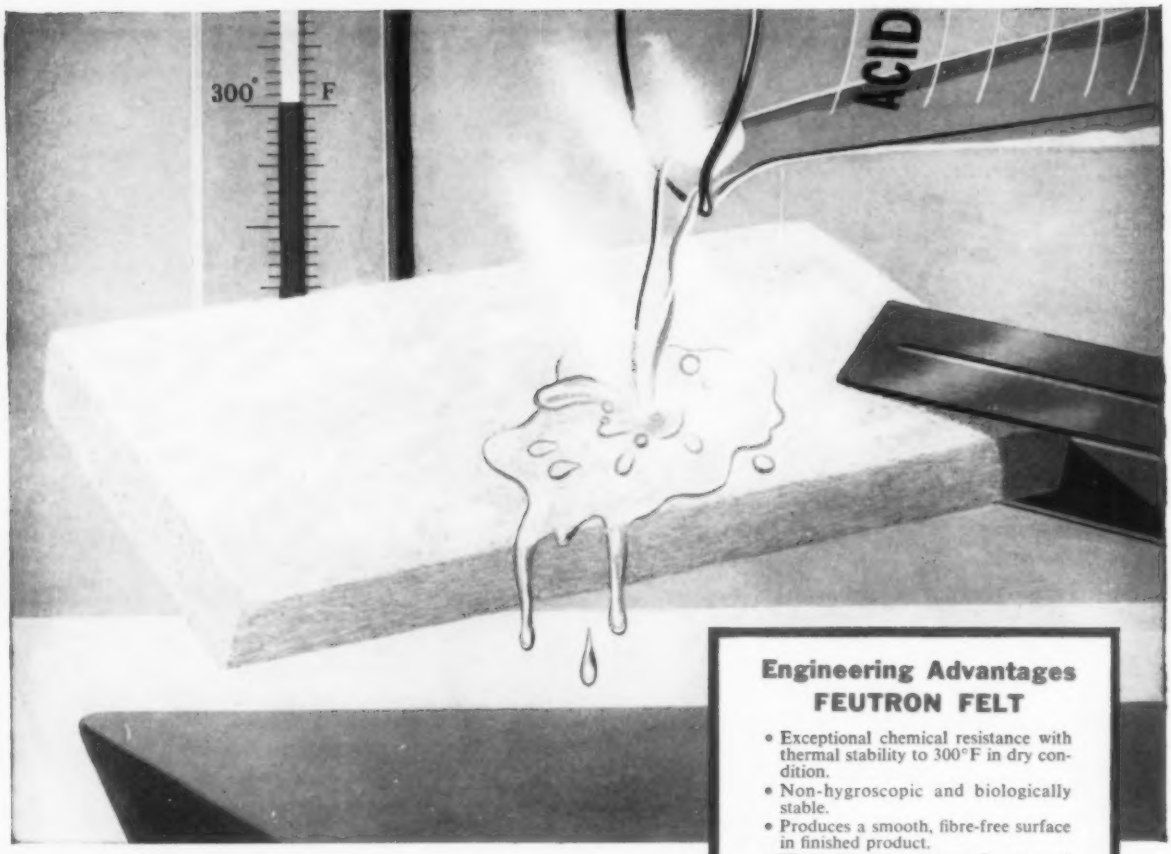
How many materials are used in electronic equipment? At least 150, says Aries Associates, and an increasing number are specially produced. Included on the list are special wire and glass products, high-purity inorganic compounds, cermets, casting resins, elastomers, and resin-based adhesives. A few companies, says Aries, are already establishing electronic materials departments.

Now it's official. The terms "porcelain enamel" and "porcenamel" are restricted to a "substantially vitreous or glassy material which is fused to the surfaces of a metal." This definition, applied by the Federal Trade Commission in a decision which the Porcelain Enamel Institute says has now been upheld by the US Court of Appeals, closely parallels the official ASTM statement: "Porcelain enamel is a substantially vitreous, inorganic, or glassy material bonded to metal by fusion above 800 F."

Lower prices for metals and metal compounds are good news for materials users. Down within the past month are copper (to 25¢), cadmium (to $1.55/lb.), lithium hydroxide (to 55¢-56¢/lb.), and thallium metal (to $7.50/lb). The latter has been reduced $5 a lb, American Smelting & Refining says, to help broaden its market. It's a relatively rare metal, now used in some low-melting alloys and insecticides. (For news of exciting developments in other rare-but-ready metals, see March 17 issue.)

Feutron Felts

Withstand High Temperatures...Corrosive Conditions!



These are the toughest Felts you've ever seen!

FEUTRON Synthetic Felts possess the same chemical and heat-resistant properties as the fibers they are made from . . . Nylon, Orlon, Acrilan, Arnel, Dacron, Dynel, Vinyon . . . all the newest synthetics!

Now you can completely overcome acid, alkali, solvent and other chemical environments . . . and temperatures up to 300°F . . . with the right FEUTRON Felt. These mechanically-interlocked synthetics resist corrosion. You can wash and re-use them. And, being fibrous, they give you better flow-rates.

A wide selection of FEUTRON styles and sizes . . . and precision-cut parts . . . are available. Mention the application in which you are interested . . . on your company letterhead, please . . . and we will send appropriate data sheet, complete with samples. And remember . . . quality AMERICAN Felts are made to the highest standards in the felting industry!

Engineering Advantages FEUTRON FELT

- Exceptional chemical resistance with thermal stability to 300°F in dry condition.
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- Produces a smooth, fibre-free surface in finished product.
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- Good resin-to-fibre adhesion.
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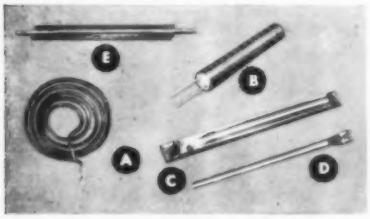
How to choose electric heaters of the right type and size for your design

Here is condensed information to help you get the most economical electric heater for your surface heating design problem.

Two factors generally determine which type heater should be used for any particular surface-heating application. They are: the physical characteristics of your product, and the surface temperature required.



General Electric *tubular heaters* (a) can be formed to unusual shapes and may be "cast in metal" as part of your product during manufacture. They may also be located in grooves, inserted into drilled holes, immersed in liquids, wrapped tightly around the surface or spaced away.

G-E *cartridge heaters* (b) are ideal for "spot" heating of small areas. Short and compact, they can be easily inserted into drilled holes within the machine or surface.

For flat metallic surfaces, such as hot plates, platens and dies, ***strip heaters*** (c) may be clamped on or spaced away. General Electric ***insertion heaters*** (d) are ideal for heating hollow bolts for high-pressure steam-shell joints to prevent steam leakage.

For warming tables, and preheating plates, G-E *vane heaters* (e) may be clamped on or spaced away.

To figure the amount of heat required for your application:

1. Find the volume in cubic inches of the material in process.
2. Figure needed temperature rise in degrees F (subtract initial temperature of material from desired final temperature).
3. Find heat absorbed by material (Table 1 applies to all materials except those listed in Table 2). Values from Table 2 should be added or subtracted from values in Table 1 to correct it.
4. Determine the total surface area of the platen.
5. Using this area and the desired final temperature, check Table 3 to get heat losses of platen.
6. Add kilowatts computed in Step 3 to those computed in Step 5. You now know how much heat is required.

For complete information on sizes and ratings of General Electric heaters, send coupon below.

DELIVERY TODAY: Popular sizes of General Electric heaters are available today from General Electric stocks near your plant.

SPECIAL SAMPLES: Your General Electric sales engineer can advise you on special heating problems. If special heaters are required, he will provide samples.

PROMPT SHIPMENT: General Electric's new Industrial Heating plant at Shelbyville, Indiana, is now geared to give excellent shipping dates on heaters for your production needs. Just call your nearest General Electric Apparatus Sales Office and tell us your requirements. General Electric Company, Schenectady 5, New York.

TABLE 1—HEAT ABSORPTION IN KILOWATTS OF MATERIAL IN PROCESS

Volume of Material in Process (cu. in.)	Temperature Rise in °F					
	50	100	150	200	250	300
1	.006	.012	.018	.024	.030	.036
5	.030	.060	.090	.120	.150	.180
25	.090	.180	.270	.360	.450	.540
100	.360	.720	1.08	1.44	1.80	2.16
500	1.80	3.60	5.40	7.20	9.00	10.8
1000	3.60	7.20	10.8	14.4	18.0	21.6

This table is based on a ten minute working cycle. If working cycle is other than 10 minutes use following formula to correct values: 10 divided by the number of minutes in the cycle times the kilowatts given above equals the kilowatts at the new cycle. Table 1 will apply for all materials except for those listed in Table 2. Apply correction factor if needed.

TABLE 2 CORRECTION FACTOR

Material in Process	Subtract or Add % as indicated to figure in Table 3
Aluminum	−30%
Dry Wood or Paper	−50%
Wet Wood or Paper	+20%
Glass	−40%
Rubber	−30%

TABLE 3*—PLATEN HEAT LOSSES IN KILOWATTS

Surface area of metal platens in sq. inches	Final temperature in degrees F of metal platens			
	100	200	300	400
100	.024	.080	.160	.280
250	.060	.200	.400	.700
500	.120	.400	.800	1.40
1000	.240	.800	1.60	2.80
2000	.480	1.60	3.20	5.60
3000	.720	2.40	4.80	8.40

*This table based on platens being completely uninsulated.

GENERAL ELECTRIC

Section B723-12, General Electric Co.
Schenectady 5, New York

Please send GEA-6146, Surface Heating Handy Selector Guide and GEC-1005, Catalog of G-E Heaters and Devices.

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News about R&A SINCE 1913 **Adhesives**

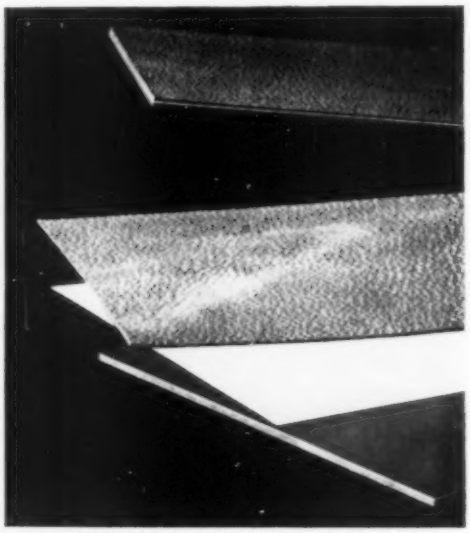
FOR ALL METALS AND ALL PLASTICS

New adhesives in dry film form cut waste, handling costs...

- *Minimize fire hazards and odor problems*
- *Eliminate costly liquid-handling equipment*
- *For permanent bonding of plastics, films, foils, metals*

Now you can cut labor costs, stop multiple handling, minimize waste and eliminate sloppiness, while insuring peak efficiency and economy in your mass-production flat-surface bonding operations.

These new PLYMASTER® synthetic rubber-resin adhesives in *dry film* form are ideally suited for the permanent bonding of flat metal sheets; flexible plastic films to rigid and semi-rigid metals and plastics; metal and plastic nameplates; metal and plastic skins to honeycomb cores of paper, metal, balsawood, etc; glass; ceramic; and a host of other materials.



Vinyl sheet bonded to polyester board and to aluminum with new PLYMASTER dry film adhesive.

INTERNALLY REINFORCED

PLYMASTER V-2 (approx. 11 mils thick) consists of a porous fiberglas mat which has been impregnated with a liquid adhesive to achieve a dry, latent adhesive film that is internally supported for additional cohesive strength. (Its thickness contributes valuable void-filling properties, too!)

PLYMASTER V-3 (approx. 4 mils thick) substitutes a special high-strength porous paper as the carrier in place of the glass mat, giving you a thinner film at lower cost in exchange for slightly lower physicals in some (not all) applications.

SWIFTLY, EASILY REACTIVATED

Both these new films may be reactivated with common solvents to bond at room temperature. Where heat and pressure are available, they can be swiftly heat-reactivated to achieve bonds with tensile strengths in excess of 1,500 psi.

TECHNICAL DATA AND FREE SAMPLES

Write for free 10-page Special Product Report on these new PLYMASTER dry film adhesives. If they are applicable to your current bonding problems, we'll be glad to send samples for your evaluation . . . without charge or obligation, of course.

Where the design demands liquids...

If existing equipment or the configuration of your materials makes the use of PLYMASTER® films impracticable, let us examine your adhesive bonding needs in the light of the more than 650 *standard* liquid, paste, and powder BONDMASTER® formulations.

FOR ALL "CHEMICAL FASTENING"

Whether your "chemical fastening" problems involve plastic foams, or rigid solids, or flexible films — to themselves, to plastics, or to metals — chances are there's an existing formulation in our line that will provide an efficient, cost-cutting solution.

If you will tell us the materials you are working with and the end-use service conditions you expect of your assembly, we'll be glad to send detailed technical data on applicable adhesives.

SEND FOR FREE DATA

Better still, send for our Problem Analysis Form to help you define your specific, current problems so that we can eliminate delay in sending you samples for evaluation.

R&A

RUBBER & ASBESTOS
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235 BELLEVILLE AVENUE
BLOOMFIELD, NEW JERSEY

the PACE of CHANGE

Several months ago (*PE—Sept. 23'57, p. 32*) we pointed out that 13% of 1960 civilian-goods purchases would be of products not yet developed. This statement now is underscored by two paragraphs in the President's Budget Message. In essence, they report:

> **"Total Government expenditures (1) for all procurement . . . (2) for atomic energy, and (3) for all scientific research and education will be approximately $21.1 billion in 1958 and $21.6 billion in 1959, compared with $20.5 billion in 1957. Within these totals for procurement and science, we have gradually but substantially changed our emphasis. This . . . continuing attention in recent years to new concepts of defense is shown by the fact that more than 75% of the total funds for procurement in the 1959 budget and 1958 supplemental requests is programmed for new types of equipment which had not been developed in fiscal year 1955 or were not being bought in production quantities in that year . . ."**

Consider, just for a moment, how many dollars must be spent each year for the obvious and standard defense supplies—clothing, food, trucks, shovels, paper, soap and so on. **Yet these take only one dollar in four—the other three go for new products of research and development.**

This 3:1 proportion may be expected to mount, because defense spending is merely reflecting the character of the technological situation. The pace of development—civilian and military—is accelerating on a geometric basis. The millions of dollars currently being poured into civilian R&D have yet to pay off—target date for this is the early sixties, because the development cycle is still about seven years. And more billions are going into current military R&D.

It is difficult for some oldsters to visualize either these amounts or this pace of change. Someone has said that man has made greater development in the past 100 years than in all his previous existence. We submit that it is rapidly becoming apparent that **he has also made more rapid strides these past ten years than in the previous 90.**

Military necessity, prosperity, and scientific research techniques are superficial reasons. Behind these is the fact that we are entering an age in which **man's greatest endowment over other animals, his intellect, is really being put to work.**

But intellect alone is not enough; it must be supported by the will and the ability to do—and **do now.** This is the engineer's special province, the translation of the outpourings of the scientific intellect into products that can be used by people. And because he has this vital ability, **the engineer is the essential man in the years immediately before us. The products which he translates from research will pace—and pay for—the further advances of science.**

TECHNICAL DATA

HYDRAULIC SERVO MECHANISM

ROTARY TYPE 2000 SERIES

This Behlen servo mechanism has been designed for ready adaptability to many types of heavy construction and agricultural vehicles. It can be used as a power steering device or wherever a rotary servo motion is required.

Economy and simple installation are achieved by combining controller and actuating parts into one compact unit.

The power source in the unit is a gear motor that will rotate any number of turns under full power in either direction.

A spool valve assembly performs two functions within the housing unit — it acts as both the mechanical and hydraulic connection between the input and output shafts. Oil flow is diverted to either side of the gear motor and shifts laterally under the control of the input shaft. Although flow is continuous, the motor shaft rotates only until at least

The power unit is mounted anywhere along the steering wheel shaft. While the Power-Steer operates as a servo mechanism between the steering wheel and the front wheels, its design includes an effective means of blocking and controlling road shocks. This is accomplished by a reversal of the basic principle. Any shock transmitted to the steering wheels shifts the spool valve which instantly pressurizes the face of the gear motor that

The Power-Steer

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WESTERN UNION
TELEGRAM

W. P. MARSHALL, PRESIDENT

1201

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RESERVE PAGE SPACE FEBRUARY 24 ISSUE FOR IMPORTANT MESSAGE FOR ORIGINAL EQUIPMENT MANUFACTURERS. DUE TO EXPANDED PRODUCTION FACILITIES BEHLEN HYDRAULIC ROTARY SERVO MECHANISM NOW AVAILABLE TO OEM ON WIDER SCALE. HUGE DEMAND IN PAST HAS BEEN FROM PRODUCTS WHERE MANUAL LABOR NEEDED TO BE REDUCED. FOR EXAMPLE, SINCE 1952 THIS BEHLEN UNIT HAS ADDED SALES IMPACT OF POWER STEERING TO FARM TRACTORS, ROAD EQUIPMENT SELF-PROPELLED VEHICLES. FOR LAST TWO YEARS HAS GONE ON LEADING TRACTOR LINE AS ORIGINAL EQUIPMENT. INVITE OEM PRODUCT RESEARCHERS TO SEE HOW EASILY WE CAN ADAPT THIS SERVO MECHANISM TO THEIR PRODUCTS. OUR PRODUCTION MANAGER HOWARD CHRISTENSEN WILL GIVE THEM HIS PERSONAL ATTENTION. REGARDS=
W D BEHLEN PRESIDENT=

THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

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Dept. PE-2 Columbus, Nebraska

Struggle for Science Simmers on Seine

PARIS—Shadows still darken relations between the distributors of happiness and the dispensers of knowledge in this City of Light.

The 13-year-old battle between wine merchants and scholars over construction of new science buildings where the wine center now stands in the heart of Paris is approaching a showdown. The Wine Wholesalers, in an effort to resolve the problem, have hailed the Sorbonne science faculty into court.

Solution appears to hinge on court orders, availability of funds from the Ministry of National Education, and assurances that Halle aux Vins occupants get new, yet equal, facilities.

Wine merchants estimate current property value at over $107 million, annual sales at over $140 million. So far, they have refused to permit erection of two new science buildings on the site jointly proposed by the Sorbonne and Education Ministry in accordance with a municipal order.

The merchants contend the order calls for indemnities to be paid in the event of eviction for public reasons. They say, they have no assurances on this point and efforts to contact school authorities have been ignored.

Furthermore, they claim educators have had architectural plans of buildings approved that would permit sidestepping of major indemnity payments. The plans show elevated buildings with stanchions that would straddle present rail and truck entrances to the market. This, the merchants declare, would tie up business.

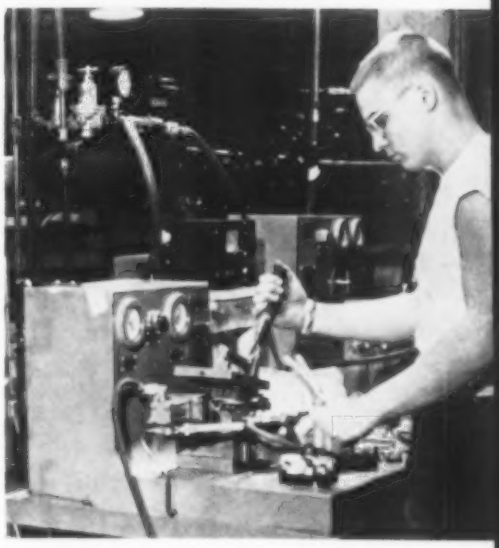
Meanwhile, educators say new highs in science-student enrollment make the need for classroom space urgent. Enrollment in science courses is now between 15,000 and 20,000 at Paris U.; officials estimate that within 10 years science-course enrollment will reach 40,000. They contend that additional space provided by new buildings would permit 8000 students to relocate.

As the battle for study space enters the halls of French justice, educators point out that next to funds for research, qualified technical personnel is the nation's most important resource.

Infrared Pinpoints Pinhole Leaks

NORWALK, CONN.—A new use for infrared—spotting leaks in automotive air suspension systems—has been developed by Perkin-Elmer Corp. Instrument is an infrared leak detector using nitrous oxide as tracer. Already in use on some '58-model assembly lines, the tester is expected to find wide application in aircraft, missiles, air conditioning, and industrial air control.

Test sequence for the unit, which can be operated by nontechnical personnel, involves introducing the gas into a closed system and detecting its presence as it escapes. By manually moving a probe over the nitrous-oxide-pressurized system, the operator can both see and hear evidence of a leak. Variations in loudspeaker pitch and meter reading lead to the leak point. Within 3 sec, gas concentrations as small as 1 ppm of normal air show up. Researchers report nitrous oxide is particularly suitable for detection because it is nontoxic, stable, and can be quickly measured by a band in the infrared portion of the spectrum.



Suspension system sleuth . . . . . . (left) checks automotive air-suspension system for leaks before final assembly. Insensitive to stray gases and contaminants, infrared leak detector is first of its kind used by major automakers.

Redstone to Sergeant to Satellite

NEW YORK—It took the Army just one Redstone missile and 17 modified Sergeant rockets (an Army tactical surface-to-surface missile using a solid fuel) to get the Explorer into orbit. But in several respects Explorer differs from Vanguard which had been scheduled to be the first satellite.

Why the bullet-shaped instrument container? Dr. Henry Richter of the Jet Propulsion Lab. of the California Institute of Technology, where the Explorer was assembled, says the cylinder is easier to work with and saves weight. Vanguard which is now planning its third orbiting attempt, was designed as a sphere on the theory that this is the ideal shape because drag is equal in all directions. Cal Tech disagrees, adding that the antennae change all this, introducing an electrodynamic phenomenon known as the Jastrow Effect (after the Naval Research Lab scientist who first postulated it). In orbit a satellite picks up negative ions, finally assuming a negative charge. This charge then repels electrons, cloaking the satellite in positive ions. These form cylinders along the antennae causing as much drag as the neutral molecules with which the satellite collides.

Explorer is spinning at 750 rpm; Vanguard will tumble. JPL believes that a spinning cylinder will give a flatter orbit and better scientific data than a tumbling sphere. The Explorer is orbiting at from just under 200 to 1600 mi. However, the sphere and cylinder are just two approaches to the same project; and at the moment one cannot be rated over the other. Dr. Richter says that the present orbit is higher than expected. A 1200 to 1300 mi. apogee was expected with the perigee where it is.

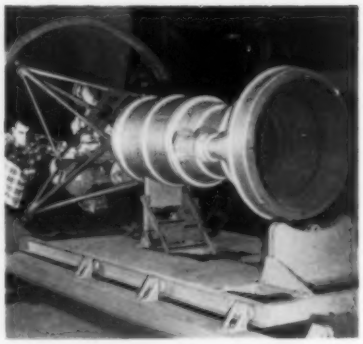
Satellite Surface Coating—Vanguard uses gold plating with a layer of sili-

con monoxide to keep temperature fluctuation within the operating limits of the electronics. Cal Tech used a similar approach for the Explorer, but their satellite is stainless steel with 8 equally spaced ¼-in-wide, white aluminum-oxide stripes, the percent of surface covered calculated to control temperature. The instrumentation section is coated similarly. Outside-temperature fluctuation is from plus to minus 100 C. Insulation should keep inside temperature of the satellite at from 20 to 40 C.

To minimize the possibility of spin damage caused by the satellite's 750 rpm, parts were placed according to their sensitivity—quartz crystals right on the spin axis, transistors next, and batteries on the outside.

Sputnik gave no help to the designers of the Explorer, according to Richter, but it did give the tracking stations some practice. No one here has figured out the technical information the Sputnik telemetered. It has been said that the Explorer will help determine accuracy of the Russian's claim on Sputnik sizes. This will be done by measuring drag coefficients, estimating the weight-to-drag ratio. However, with an estimated life of up to 10 yr (constantly revised), it may be 7 or 8 yr before Explorer's orbit will show measurable change.

Batteries—Mercury cells are used; they have best energy-to-weight ratio, plus reliability. Solar cells, according to Richter, are unreliable, fragile, susceptible to meteor damage. Also, because solar batteries do not work in the shade, a storage battery would have been required.



A thrust and range booster . . .
. . . Hydyne, a new high-energy liquid fuel developed by Rocketdyne, was used in the Jupiter-C to increase the thrust and the range of the conventional Redstone engine (shown) above by 12%. Properties of the hydrazine-based compound closely duplicate those of alcohol, the standard Redstone fuel. Engine can use new fuel without any extensive modifications.

Information Collection – The Explorer will collect data on cosmic rays and meteorites. Army's second satellite will also collect cosmic ray information, basically, but will have a tape recorder to store information and transmit it on radio command signal. Navy's Vanguard will collect information on ionization, erosion, ultraviolet rays, and other areas that make up the six-part satellite program.

Explorer is also equipped to detect the abrasive effect of the dust-like clouds of micrometeorite particles. An erosion gage containing a wire grid of 12 wires arranged in parallel records this abrasion. The wire grid will be eroded and its wires broken. As each wire is cut, there will be a small increase in frequency in the low-power transmitter—indicating a micrometeorite of five microns or larger. The satellite carries an impact microphone next to the grid with an amplifier and scaler to determine absolute size and momentum of a particle.

Tracking—Some 12 minitrack stations and 6 micro-lock tracking stations around the world are tracking the Explorer. Minitrack is the primary tracking setup. The micro-lock system is a back-up measure being run for the Army by CIT's Jet Propulsion Lab. Information telemetered from the satellite is recorded at the minitrack stations and sent to JPL. From there it is sent to the universities in the US handling different phases of the experiment. World data centers will get the information in about 8 months.

Information on tracking is sent from the minitrack stations to the Vanguard control center at the Naval Research Center in Washington, where it is relayed to the computing center in downtown Washington. Here future paths of the satellite are computed and the information sent out to the tracking stations.

Satellite-Mail Stirs Rocketeer Imagination

Bonn—Income provided by letter-carrying satellites can finance space research and travel, including an expedition to the moon, says missile expert Dr. Wernher von Braun. In a message of greeting to former cohorts of the German Society for Rocket and Space Technology observing their 10th anniversary in Stuttgart, von Braun suggested that half-a-dozen such satellites, criss-crossing the globe 16 to 18 times a day, could insure that a dispatch reached an addressee within an hour or less from time of sending. Satellites would be equipped with magnetic recorder telecommunications and, on a signal from a ground control station, would drop their delivery and receive a new mail batch from earth. Satellite mail, at a charge of less than a quarter of a cent a word, is one of many ways space travel can be put on a sound economic footing, the German-born scientist declares.

Also looking to the future, Eugen Saenger, Society president, foresees a steadily declining role for manned aircraft as a military weapon, compensated by a mounting importance in civil aviation. By 1960 he envisages manned-aircraft speeds of 3375 mph, upped to 6250 mph by 1965, and to 17,500 mph by 1970. He also predicts that unmanned research rockets will hit speeds of 62,500 mph within a decade, and by 1970 the first manned satellite will be launched.

Future fuel, Saenger believes, will be thermonuclear energy. Photon-powered rockets will approach the speed of light by the year 2000. He has urged Germany's Federal Government to invest $1 billion annually in space research, and exhorted researchers and engineers to start developing practical techniques by 1970.

Saenger pointed out that on economic grounds, Germany must renew its aviation and space activities, otherwise she would lose her position as the world's fourth biggest industrial nation and fall far behind, scientifically and technologically, to the status of an undeveloped nation.

Herald Laminated Plastic Use in Planes

Los Angeles—Rigid construction and performance specs for Army's newest target drone points to wider use of plastic laminates in future aircraft designs.

Drone under test by Army Ordnance Corps features extensive use of reinforced plastic laminates for fuselage, vertical stabilizer, and wing edges. Radio-controlled robot, built by Radioplane Div. of Northrop Aircraft, cruises at 365 knots at 30,000 ft, performs a wide variety of missions and provides a realistic target for anti-aircraft gunnery and anti-missile practice. Weighing a half-ton, the unique plane has a wingspan of 13 ft and a length of 15 ft.

To meet stiff demands for structural stability in launching and recovery operations, Radioplane uses low-pressure laminated glass fiber base bonded by a polyester resin for fuselage, stabilizer, and wing leading and trailing edges. Result is a plane capable of standing shocks and strains of zero length launching and recovery in rough terrain with a minimum of damage.

Use of plastics reduces probability of major structural member cracking, and permits field repairs to be made should some damage be found after robot parachutes to earth at mission's end. Special patch-up kit includes glass fiber sheets, razor blade for cutting, resin, catalyst, and paper cups for mixing.

All-weather fuselage is formed in matched metal molds. Vacuum forming is used for tail cone, engine cowling, stabilizer, hatch covers, and wing edges. Finish, red except for white upper wing surface, is a colored organic paint.

Plane can be quickly disassembled into its major components for transport and repair. Its guidance system uses 3 command channels. These in part control roll attitude to a maximum of 50 deg, pitch to a maximum 30 deg, and initiate the recovery system. Flight course can be controlled within a flight corridor of 200 yds by the "pilot" using a small control box and observing the drone directly or by plotting board track.

Versatile mission capabilities for robot include carrying an electronic scoring system to record near-hits by anti-missile projectiles; transporting sensitive "snooper" equipment to detect and measure radiation; flying smoke-generating devices for visual tracking. Drone's zero-length launcher uses JATO bottles on a frame connected by retractable fittings at the forward and aft end of the JATO bottles.

Parachute recovery is initiated by ground-command or, automatically, by 5-sec loss of radio command carrier or electric power. Extensive use of foamed sections for added structural strength gives the plane adequate flotation for recovery over water.

The RP-77 is only one model of three planned. The other two models will use inexpensive reciprocating engines.

Poised plastic . . .

. . . RP-77 radio-controlled drone uses a single-stage, axial-flow free-turbine engine with modifications for weight reduction. With ram air, it delivers 294 hp at 300 knots. Special design of the air passages gives a reverse direction of flow of some of the inlet air across the oil cooler and exhaust stacks with a minimum velocity loss because of turbulence. The fuel tank is also of plastic. Besides the five-foot launching platform shown here, the drone also has a rotary launcher which tethers the plane to a central post until flying speed is reached.

Ingot peeler . . .

. . . being used by two companies in Europe is reportedly reducing conditioning costs by 10 times that of any present method. The peeler utilizes about 80% of stripping heat and obviates annealing. Basically a miller, electro-hydraulically controlled, the machine increases output ten-fold and cuts material handling. Steel grain is said to be refined. Temperature drop during peeling is 200F. Total non-productive time for the peeling process is 90 sec. With 2150-mm dia. cutting head with 48 cutting edges, 7200-lb ingots have been cut in 35 sec. per face. Stock removal can be adjusted to about 7 or 8 mm. The machine was developed by Innocenti of Milan, Italy.

Tale-telling tape . . .
. . . of Dataphone transmitter delivers message at speeds 8 times faster than originally recorded from business machines. Same type receiver unit re-converts message tones to readable copy.

Dataphone Puts Zing in Ring

NEW YORK—A new system that transmits business data over regular telephone lines 10 times faster than any method now used will be put into limited operation this month by the Bell System. Called Dataphone, the service will eventually reach any point in the continental telephone network.

Here's how it works: teletypewriters or other business machines record information on tape. Dataphone equipment, about the size of a cabinet-type drinking fountain, accepts the pulses and converts them into audible tones. These are carried over the wires to receiving points at speeds up to 800 words a minute. At the receiving end the process is reversed with the tones being converted into electrical pulses to produce tapes or readable copy.

Any type of data that can be recorded on tape or punched card can be sent. A recorded carrier subset unit records data for transmission at speeds from four punched cards per minute to 100 items per minute. This is transmitted by magnetic tape over telephone lines at speeds up to 800 words per minute.

This information is recorded at the same speed and converted automatically to the speed of the original recording equipment. Recorders can be linked directly to punched tape, punched card, or magnetic tape equipment of teletypewriters, is desired.

System also permits remote-control operation. An accumulated volume of messages can be "stored" on magnetic tape, sent as a single transmission at high-speed after regular business hours.

Switch to West Coast Ups Ship-making Costs

WASHINGTON—The Federal Maritime Board has used for the first time a two-year-old law that allows it to place shipbuilding contracts with yards that are not low bidders. The purpose of the law is to keep the yards in existence for defense-mobilization purposes.

With the President's approval the board awarded contracts worth $46-million to build four new merchant ships to two Southern California shipyards—The National Steel and Shipbuilding Corp., San Diego, and Todd Shipyards at San Pedro. The action will cost the government an additional $6-million over the estimated $36-million in construction subsidies, because West Coast prices are higher than East Coast bids.

The action drew strong protests from East Coast yards who see it as a forerunner of what to expect in the upcoming multi-billion dollar merchant-ship replacement program that is just beginning to get started.

Some see the move as a direct primer to Southern California's unemployment, which is up 1% over East Coast areas—but not for unemployed shipyard workers. The two yards getting the new construction have not been active in shipbuilding for some time. The National Steel yard is known for its tuna and small ship construction. It will have to lengthen its ways to accommodate the two big ships it will build. Todd has been closed since the war and has just recently reopened.

Changeable Jet Solves Flight Riddles

BUFFALO—A T-33 jet trainer, that can produce flight characteristics of other planes, including designs not yet off the drawing board, is proving to be a unique flight-testing tool. Developed by Cornell Aeronautical Laboratory under sponsorship of Air Force's Research and Development Command, it's being used to solve stability and control problems and to provide data on certain flight characteristics not obtainable in a wind tunnel.

The T-33's automatic control system can vary flight characteristics about all axes—vertical, lateral, and longitudinal, to give the effect of shorter wings, larger tail, different mass distribution, etc. The system is being used to simulate handling characteristics of "century" series jets and can be applied to more advanced planes still in blueprint stage.

CAL has worked out an "artificial feel" system for the T-33 so that elevator, aileron, and rudder controls are linked to individual servo-mechanisms. An auxiliary set of control surfaces has been added for simulation and elevation of the phugoid, or long period, oscillation. Also the trainer's original nose has been replaced with a larger one from an F-94 to accommodate some of the automatic control system components, equavalent to a medium-size analog computer.

In flight, the rear or "safety" pilot, takes off and lands the plane as a near-normal T-33. At test altitude, the forward test pilot commands the plane using the artificial feel system that provides a wide range of static and dynamic control characteristics.

Bits and Pieces

Shades of the British Comet: fatigue cracks in the inner section of the low boom spar have grounded 21 of the first Viscount 700 turboprop airliners. Cracks at the bolt holes in the boom at the undercarriage attachments of the British plane were caused by fretting of the skin on the boom in this region during landing. . . . Combining rotation and vibration, a new barrel finishing system cuts time cycles by up to 70% and makes it possible to barrel finish inside diameters. Owned by the Minnesota Mining & Mfg. Co., St. Paul, it has cut jet-blade barrel finishing from 40 to 16 hours. Turning at from 4 to 20 rpm, the barrel vibrates at 2,300 cpm. . . .

USSR SCIENTISTS READ ENGLISH

The AIEE is now making available to its members translations of four leading Soviet scientific and engineering journals. Arrangement is with Pergamon Institute, N. Y., that estimates over 80% of Russian scientists-engineers read English, while only 5% of their American counterparts can read Russian. . . . US is principal market for British cars. Last year 95,000 came to this country compared with 38,000 the previous year. . . . The first postwar agreement under which an American aircraft engine will be built in England has been signed by General Electric and DeHavilland Engine Co. That company will build the 1,000-hp T58 turboprop engine. . . .

6-CYLINDER REAPPEARING

The 6-cylinder car isn't completely out. Dodge just announced that it would offer an additional six-cylinder Coronet two-door hardtop. . . . Rep. Price (D-Ill.) and Rep. Van Zandt (R-Pa.) have introduced legislation in the House designed to improve mathematics instruction in the secondary schools and to provide refresher courses and fellowships for high school mathematics and science teachers. . . . Convair is pushing development of techniques for building an all-welded airplane. Resistance welding will be used to make the wing and fuselage sections, eliminating structural riveting. Benefits: weight saving; better resistance to high temperature, reduction in manufacturing costs and greater freedom in design.

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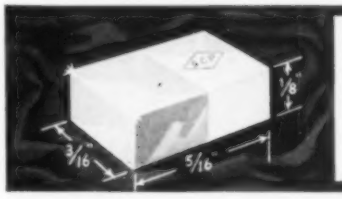
A clear and welcome statement from the Bell Helicopter Corporation of Fort Worth, Texas, needs no embroidery:

> "The silver graphite brushes supplied us by Superior Carbon Products, Inc. are used in conjunction with our XH-40 in flight tracking actuator. It is expected that in this application they will give their usually outstanding service and life."



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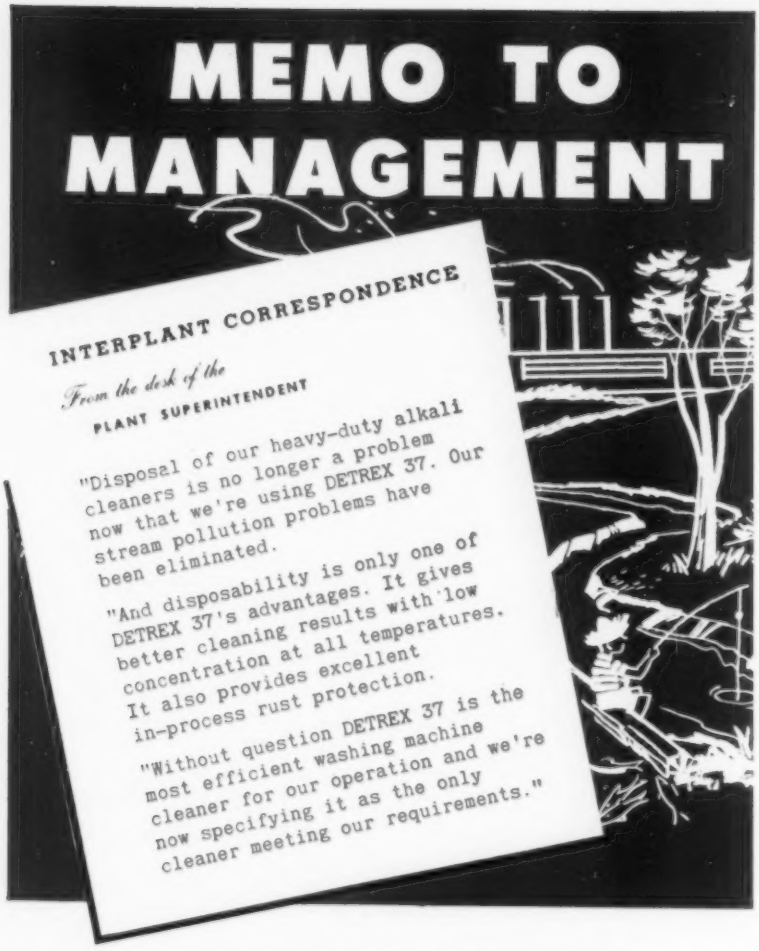
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INTERPLANT CORRESPONDENCE
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NSPE Has Beady Eye for Pay Proposal

WASHINGTON — Hitting hard at the Administration's proposed pay schedule for government scientists and engineers, Paul H. Robbins, executive director of the 43,000-member National Society of Professional Engineers, declares the budget-conscious proposal could prove seriously detrimental to the morale of these groups and result in an ever higher resignation rate from Federal service.

He says the Society's position is based on the belief that thousands of engineers and scientists would get no pay increase whatever, or only a small one under the proposed recommendations. In effect, Mr. Robbins noted in a letter to senators and members of the House Post Office and Civil Service Committee, the measure would deny the full benefits of an over-all classified pay raise to those persons who have been boosted to the top step of their grade as a result of recent Civil Service directives.

Urging the Government to do all in its power to elevate scientist and engineer salaries to more closely approximate wages paid to industry counterparts, the Society spokesman said that a limiting salary provision in the Administration's new pay schedule would nullify recent measures designed to close the gap between Federal and industry-wide scientist-engineer salaries.

An income-and-salary survey made by the Society shows a 21%-median salary increase for all engineers from 1952-56, compared with a 12% increase for Federal engineers over the same period. Survey also indicates that government engineers during 1956 were paid at a 21% lower rate than their industry colleagues.

Navy Designs Special Subs For Polaris

WASHINGTON—The first three subs to be built especially for carrying and firing the Navy's new Polaris underwater missiles will be ready by 1960, and the Navy is expected to place an order for six more to be ready by 1962.

The nuclear-powered submarines will resemble the fish-shaped Albacore. Each will be 380 ft. long, with

a beam of 33 ft, and a gross weight of 5000 tons. The 320-ft. Nautilus has a 28-ft. beam.

According to latest reports the subs will have about 15 vertical tubes for housing and firing the Polaris, which is 30 ft long and 5 ft in diameter. The best information is that firing of the missile will be a two-step operation. The missile will be shot from the tubes much like a conventional torpedo. But after Polaris is well clear of the sub, the main propulsion, solid-fueled rocket engine will take over.

Pressurized-water-type reactors will be used for the subs, giving them a range of 100,000 mi. And the Navy is developing with it a machine to make oxygen from sea water. The subs could remain submerged indefinitely.

Fleet Tracker Readied

PITTSFIELD, MASS.—Navy fleet units will soon be operating a new fire control director for guns and guided missiles that has speeds and accuracies previously considered unattainable. Developed by General Electric's Missile and Ordnance Systems Dept. and Navy's Bureau of Ordnance, the "Mark 73" is remote controlled, operates with radar, supplying supersonic target position and travel rate data to a computer for swift check-out and evaluation.

The device, a key component in the Navy's planned fleet moderinzation program for guided-missile weapons, features a gearless power drive that eliminates all power gearing, backlash, and practically all resonance. Drive consists primarily of a large servo-controlled motor with the director mounted on the rotor of the motor rather than through the usual series of gears. Systems will be produced by GE for use with the Navy's TARTAR anti-aircraft missile.

It's a Rocket

VIENNA—Russians say they have new meteorological rocket consisting of a 6-ft, 7-in.-long head carrying instruments at top, an explosive bolt and parachute at bottom. The 16-ft-long body, weighing 490 lb, is launched in spinning flight from a 43-ft-high tower, the rocket traveling at almost 660 fps. When the liquid-fuel engine is shut off, the rocket can top 3500 fps and 11.6-mi. altitude.

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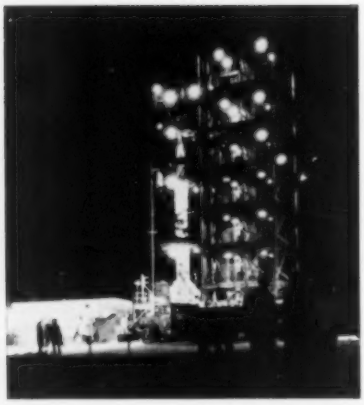
Insulative molding compounds | **Corrosion-resistant polyester** | **Low-cost control knobs**



Official U. S. Navy photo

But what if it rains?

From time immemorial, weather has upset the military plans of men. In colonial days, wet gunpowder could lose a skirmish. Today, one moisture-affected part can nullify months of costly labor on a new missile.

This helps to explain the increasing pressure on moisture-resistant insulations for electronic parts that must not fail. It explains, too, the growing interest in a relatively new Durez molding material, *diallyl phthalate*.

This is the *only* plastic that retains its high insulation values over extended periods at relative humidities above 90%.

Its arc resistance, as measured by ASTM D495 (Method A or B), can be consistently reproduced.

It does not corrode metal contact points.

Because it is a thermosetting material, it provides virtual freedom from cold flow and creep.

You can get this material from us as an orlon-filled granular blue or green molding compound with plasticity values of 10, 12, or 16 by ASTM D731. It is designed to meet the requirements of Mil-M-18794, Type SDI-5.

For a data sheet detailing properties of the compound, and of molded material, check the coupon.

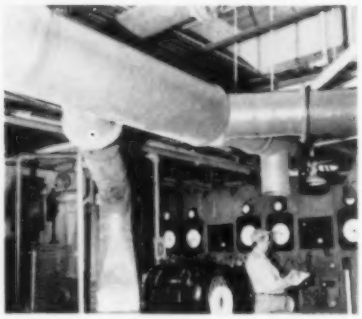
Hetron® ducts outlast metal

Perhaps you've been thinking of Hetron mainly as a *fire-retardant* polyester material.

It's true you get outstanding fire retardance with Hetron. But don't overlook its *corrosion resistance*, which is equally impressive in equipment such as this glass-reinforced ductwork manufactured by duVerre, Inc.

Venting corrosive fumes from a chemical reactor, aluminum ducts failed in 11 months. Ducts made of Hetron 92 replaced them—and have gone 17 months without a sign of deterioration.

In another plant, Hetron 92 replaces rubber-lined steel ductwork which lasted

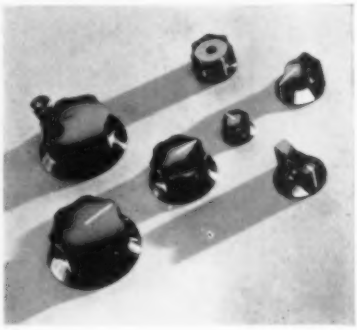


duVerre, Inc.

less than a year under the corrosive bite of wet chlorine. The Hetron ductwork, in service four years, has required no maintenance and is as sound as the day it was installed.

Because it is self-extinguishing, you can safely specify Hetron in many places where a conventional polyester won't do. Fire retardance is *inherent*—does not depend on additives that might dilute corrosion resistance.

Are you taking full advantage of Hetron's unique qualities? A check mark on the coupon will bring you an illustrated bulletin outlining properties and uses of the versatile Hetron resin family.



Ready-tooled knobs

Why tool up for a standard item like a control knob, when you can buy general-purpose knobs like these—probably at a good saving?

Many custom molders can supply knobs in Durez phenolic, from stock tooling, to fit most standard mountings. You can have them hot-stamped with numbers or characters; equipped with special motifs.

Styled as a family, they blend smoothly with modern equipment lines; wipe clean without dulling; and stand up to heat, dampness, and corrosive atmospheres. For further information, consult your molder.

For more information on Durez materials mentioned above, check here:

- ☐ Diallyl phthalate, Durez 16694
- ☐ Hetron polyester resins (bulletin)

Clip and mail to us with your name, title, company address. *(When requesting samples, please use business letterhead.)*

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PLASTICS DIVISION

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basic research PAYS OFF

In, fact, you can't afford to do without it. Here's the formula used by AT&T.

■ Frederick R. Koppel, president of American Telephone and Telegraph Co., took a look at industry research late last month and offered this advice to administrators:

"In the past, American industry led the world largely because we used existing knowledge with great ingenuity, developed new products, and introduced all kinds of inventions in organizing people and machinery.

"But now we face the new and mighty competition of science and new knowledge in the hands of determined men who have flatly told us they mean to rule the world.

"Competition on this plane cannot successfully be countered by industrial and productive skills alone, any more than the artful design of megaphones could compete with the telephone, or ball bearings in a buggy could make it a competitor of the automobile.

"Does the quest for new knowledge . . . really belong in industry? Certainly basic research must be done by the universities and government, but there is great advantage—and great need—to do it in industry as well.

"Basic researchers and development engineers, working fairly close to each other in a dynamic atmosphere, sharpen each other's wits. Why then should an industry choose to do without this stimulus—in fact, how can it afford to do without it?

"Further, the technical organization which includes a basic research group takes out insurance against possible costly mistakes. The cost of development is far greater than the cost of research, and if a big undertaking gets off on the wrong foot the price is terribly high.

"Note, too, that at any particular time, university scientists may not be working on the things that would do your business the most good . . . they may not be getting the new knowledge that you need most.

". . . While we shouldn't underestimate the cost (of basic research), we shouldn't overestimate it either . . . a large business can do a lot through expenditures which, in relation to total volume, ought not to frighten anybody.

"I think most of the hesitation about going into basic research is due to a worry that all the money may go down the drain. If you go at it the right way this ought not to happen.

"First, get the best possible people. Getting new knowledge takes a special brand of brains. And they must be well and deeply trained.

"Second, you have to have an objective but you also have to give the brains full freedom . . . (for example) we have the broad objective of improving electrical communication. This is a perfectly clear goal. At the same time it gives the research scientist full scope for the exercise of his creative power.

"The researcher must be free to do what he wants to do in keeping with the broad objective, and he knows he can do best. If a line of work is proposed and he says 'No,' take his word for it. He knows more than you do.

"The scientist must also be free to plan his work in his own way. You cannot plan it for him. This means there are no schedules. There is no program by the clock or even by the calendar.

"The research scientist should also be free to publish his findings without undue delay. And you should let him carry his work to the point where he is sure its meaning is fully grasped by those who will go on with the development.

"But . . . the most difficult essential in maintaining basic research is to keep the researcher from becoming a developer. And this is the mistake that every researcher scientist will warn the business manager against. When basic research is swallowed up by development, then basic research stops. The only assurance of getting new knowledge is to insist that the research group stay a research group. When one piece of research is done, the result must be given to others and the researchers must turn to a new problem.

"The manager will have to be patient. Our own research people say that 10 years' effort will produce real accomplishment—starting from scratch. Whenever I get impatient, there are two thoughts I use to restrain myself. The first is that research requires no more patience on my part than it does of the man who is doing the work. The second is—thank heaven we have the research that I can be patient about." ■

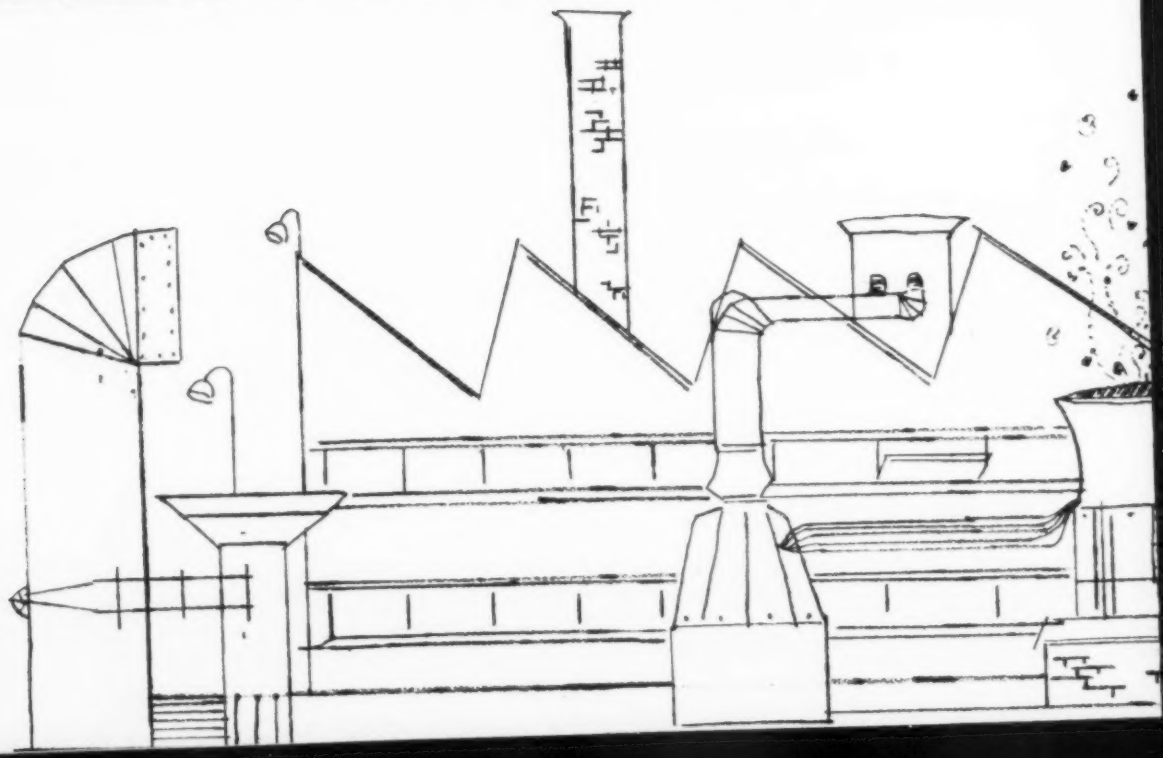
The all-out frontal attack on research is getting all the publicity these days—the implication being that if you want to find out anything about anything just collect a stable of scientists and turn them loose in the most completely equipped laboratory that money can buy.

For many long despairing months, we have been searching for a man who would reaffirm the value of individual thought—of creative experimentation in the home workshop or ill-equipped laboratory. Dr. Kroll is that man.

William J. Kroll is the developer of the basic Kroll process used for producing the metals, titanium and zirconium. Last month he received the Perkin Medal of the American Section of the Society of Chemical Industry—the highest award in American industrial chemistry. Acclaimed as "one of the greatest of the original chemists and metallurgists of our time," Dr. Kroll has made outstanding contributions to many branches of nonferrous metallurgy.

In this article we read that perhaps the most basic discoveries of our time have been made by men working alone or in very small groups, and if we discourage such work we may dry up our most valuable natural resource.

INDIVIDUAL INV



ENTION — a lost art?

DR. WILLIAM J. KROLL
Consulting Metallurgist
Corvallis, Ore.

■ In these days of post-sputnik hangover, a lot of soul searching has been going on as to why we lag behind in certain techniques, and what remedies must be applied. All this should be no surprise, we had ample warning from many competent sides (*PE*—Dec. 16 '57, p 24). We simply refused to listen. For many years Dorothy Thompson, the news commentator, criticized our educational system, especially in the high schools, and showed its collectivist slant, which favors group work, eliminates individual thought and competition and leads to conformism. Rear Admiral H. G. Rickover stressed the role of individualism as one of the most important factors in research, and C. H. Greenewalt, president of E. I. du Pont de Nemours, insisted on the need for fostering individuals with creative minds.

I too wish to take issue with those who claim that the time of sealing-wax-baling-wire science is about over, having been replaced by teamwork. This is, unfortunately, a quite general conception in government and industrial laboratories, and even in universities.

The fight of the individual against the collectivity in which he lives is as old as humanity but with mass communication and production techniques the battle is going against the individual. Our hedonistic system of education, based on Sigmund Freud's psychology of no-compulsion (which leads to conformism), has thrown the pioneer overboard and attempts to replace him with the democratic team.

Granted the team cannot be avoided in development work, is it justified in research? In group work the individual must conform, subordinate himself, and competition is ruled out—it destroys understanding. How will leadership be created in such a system?

No opera was ever composed by teamwork (not even by the Russians) and even the performances are created in an atmosphere of tension and conflict among so many "prima donnas."

When teams are put to work to make important discoveries or inventions, they either flop awfully, or succeed at far too great a cost. The individual inventor pitches his ingenuity against the financial means of his team competitors. Often what seems like a secret hand guides him to his goal.

Just look at the record of the individual inventor: The Curies needed only a shack to lay the basis for our atomic age. Fleming had only a few dishes with cultures to find penicillin and save millions of lives every year. The discovery of duralumin made by one man in a small research organization cost no more than a few thousand dollars. Very little equipment was involved in the discovery of the Mishima magnet steels or Neel's magnet iron. While zone refining was developed in the shadow of Bell Telephone Laboratories, it could quite as well have been reduced to practice with a few dollars in anybody's garage. The discovery of the debismuthizing of lead with calcium, which I made in 1918, required only a gas furnace, an iron crucible, the metals and a pair of sharp eyes.

Examples of this kind could be recounted endlessly. The important point is that the man makes the discovery—not his equipment. Many of the laboratories in the US are over-gadgeteered. They are drowned in complex equipment that usually takes more time to fix than to use. These instruments remove the researcher from his experiment—a recorder takes the place of live observation by man. Automatic research tools are asked to do the inventing and human researchers become glorified repairmen.

We must offer the recalcitrant lone-wolf searcher a haven, lest this useful species becomes extinct. High taxes, competition by government and corporation laboratories have made his life precarious. What he needs first is freedom, to satisfy his mystic needs, just as an artist needs freedom. Is there any refuge for him in the universities as a research professor? Would corporations give him any real freedom for creative projects even within budgetary limits?

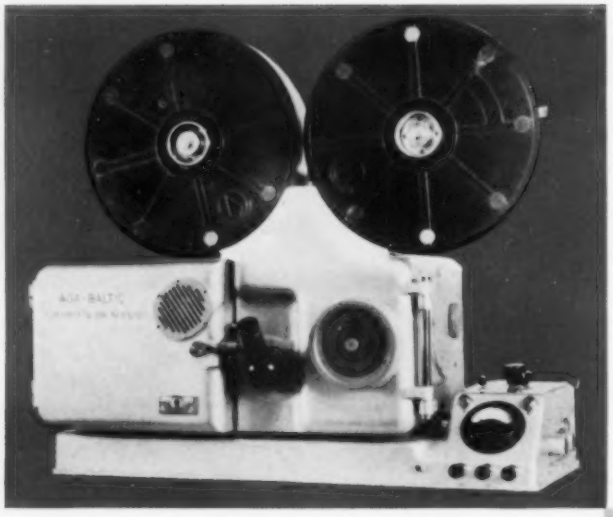
Men are born unequal of mind and body. The inventor or scientist needs to express himself—to affirm his own individual personality. To try to domesticate, collectivize and depersonalize him in a team is, psychologically, a fatal mistake. Probably it can't be done, for he maintains loyalty to the group only as long as its goals coincide with with his. When the goals diverge, he becomes sterile or quits.

But collectivism and mind conditioning have progressed. Individualism, deviationism, even when entirely ascetic, are frowned upon—here as well as in Russia—though for different reasons.

Today's Steinmetz would be turned away at the plant doors as an eccentric. He simply does not fit the pattern of organization man.

Very great discoveries remain to be made. They are still so close to the surface that nonconforming individuals can mine them. It requires only an inquisitive mind, with knowledge, with a holy urge to create, and the willingness to accept sacrifice as a way of life. ■

TRENDS



Camera (top) manufactured by Hasselblad and widely distributed in this country was designed by Sixten Sason. Above is sound-film recorder made by AGA. Pay telephone, below, was designed for Ericsson Co. At right is loudspeaker telephone by Hugo Lindstrom, made by Sinus.

in appearance design...

...IN SWEDEN

by **SIXTEN SASON,** Industrial Designer, Stockholm

Swedish industrial designers Acton Bjorn and Sigvard Bernadotte with typewriter they designed for Atvidaberg.

What is today known as industrial design has always existed, generally as the result of anonymous effort.

In Sweden, for example, there has persisted for hundreds of years a strong tradition of combining usefulness with qualities appealing to the hand and eye. The use in a self-contained, sparsely settled community, of wrought and forged iron, wood, domestic minerals and glass for the manufacture of hand tools and other objects of everyday use, has provided our present-day designers with a resourceful background for self-evident solutions of several modern design problems.

However, not until the Americans started to beat the drums about industrial design as an art in itself did the Swedish designers emerge from their anonymity. They are very technically minded, putting considerable emphasis on close interchange of ideas with the engineers responsible for the technical aspects of the objects they are commissioned to work on.

Personally, I like the sometimes contentious interplay of ideas between myself and the technical expert. It can be likened to a tennis match, in which the ball is hit back

continued on next spread

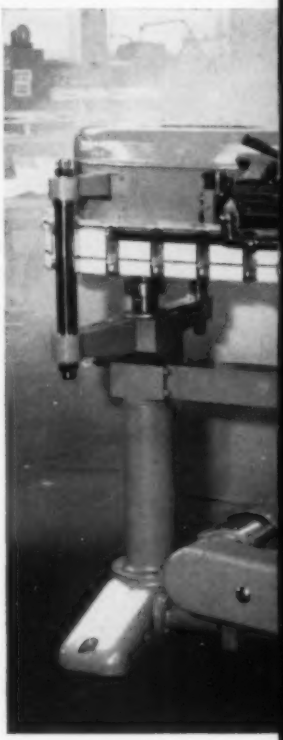
Electrically powered compressor, below right, was designed for LKAB mining industry by Rune Zernell, and is self-propelled by air motor. Compressed air is stored in tubular steel chassis. Self-adjusting wrench, below left, was deigned for AB Cromna.

TRENDS in appearance design... IN SWEDEN

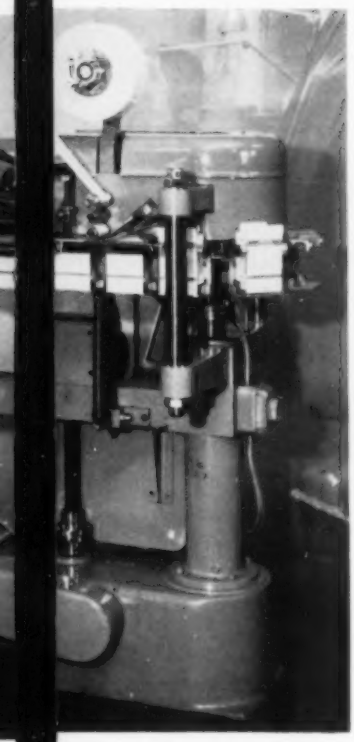
and forth in a fighting spirit, with each player applying his knowledge and skill. The master shot is likely to crop up on either side.

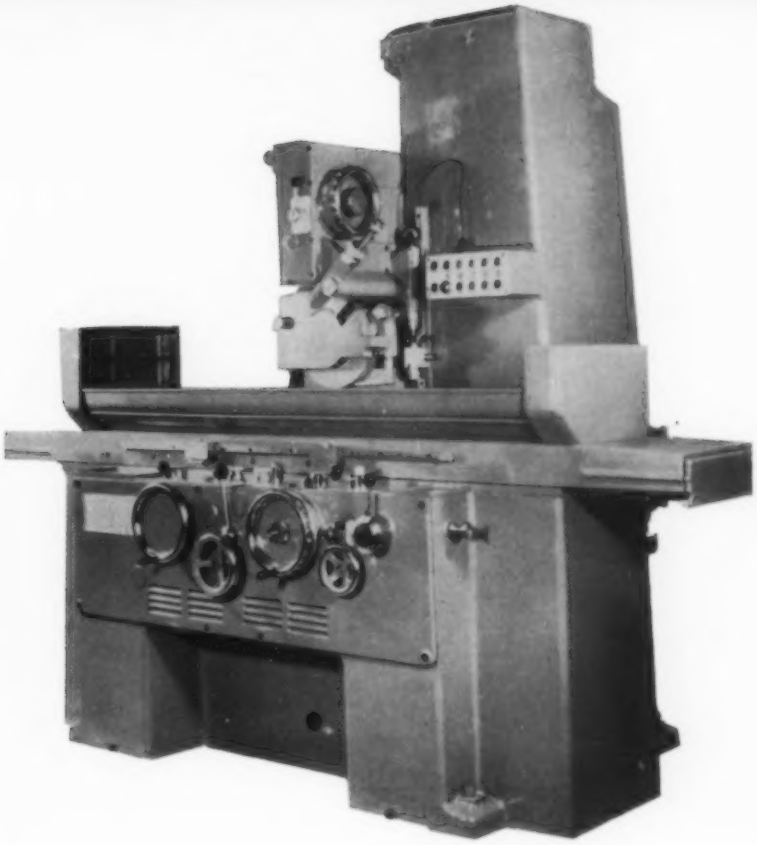
This same fruitful kind of relationship undoubtedly is commonly found in America, too, but in another way the Swedish situation presents significantly different considerations. In America, the large marketing possibilities and the demand for frequent re-styling allows the designer the possibility of making a mistake now and then. The error can always be remedied next year.

In Sweden, on the other hand, the limited market and the limited economic background for experimentation makes it necessary for the designer to plan years ahead. His designs must, of necessity, remain more conventional than those of his American counterpart. He can't afford to be influenced by temporary fashions. Our designs must anticipate the future in a way that stabilizes and brings out a kind of constant value, emphasizing usefulness, adaptability, security, price, ease of maintenance. This requirement has both its assets and its drawbacks, but it must be taken into consideration when comparison is made with U. S. designs.



Streetlight, above, won a prize at the Triennale industrial design exhibit for P. E. Heribertson. Propane-burning equipment (torch at top of page, lantern at right) were designed for AB Bahco. Self-reeling multiple electrical socket, far right, is made by cooperative Luma enterprise.





Packaging machine, left, for frozen foods is made by Aberlund and Rausing. A Malcus grinding machine is shown above. Below right — the Saab motor car designed by Sixten Sason.

POINTS

THE QUESTION: **"How do European-trained engineers compare with American-trained engineers?"**

DR. EDGAR L. PIRET
Engineering Consultant
Minnesota Mining & Mfg. Co.

"There can be no question . . .

that the system of training engineers in Europe is far more selective than is the American system. There, process of selection actually starts in the grade schools and continues through entrance examinations for the universities and technical schools. In addition, the European chemical engineering student receives, before entering a university or technical school, excellent training in the fundamentals (mathematics, chemistry, physics and language). Regarding comparative work in the secondary schools, we need only examine the quality of the product to realize there must be a great deal we can learn from our European allies. The teacher inspires a questioning attitude toward all subjects, and actively encourages discussion, analysis and controversy. The American engineering student receives through his training a combination of the theoretical approach and the practical approach—a combination which is quite uncommon in European students, who, as is well known, come from a system which tends to separate the 'thinkers' from the 'doers.'

"Admitting the limitations of any generalization, it remains true that Americans have tended to excel in the application of science, whereas Europeans have tended to be more prominent in basic research. It is undoubtedly true that in our basic-research programs we could learn a great deal from the Europeans. It is equally true that we have much to offer our European colleagues in the realm of applied science."

"The engineering mind . . .

is not limited by boundaries of country or continent. Being European-educated, and familiar with the American methods of education and training, the end result of both systems is ultimately the same. The method of training an engineer, however, is of great influence on his performance, especially in the first years of his professional activities. Engineering consists mainly in arriving at the best compromise for solving problems. It is therefore the practical experience that the engineer is compensated for and not so much his knowledge. Experience can be acquired only in time and not from books alone. In this respect the European training system requires that students obtain at least one year of practical experience even before they enter college.

"It is the practical-experience factor which makes good engineers at an early age whether American or European-educated. The European system places the emphasis on good theoretical thought training rather than training for specialized knowledge. Because of this type of training, many engineers usually have little difficulty in varying their endeavors. Their broad theoretical training provides the opportunity for them to become experts in several unrelated fields."

DR. HUGO H. WOARDMANN
President, Magnetic Research Corp.

OF VIEW

"The European engineer . . .

has been intensively trained for research and design. His American counterpart usually has broader training, more versatility, and more competence in the engineering areas that relate to production.

"This difference may be attributable in part to the traditional European emphasis on basic research, and to the European inclination to explore a specialized area in utmost detail. In America, however, flexibility and versatility are emphasized in schools, in industry and even in development laboratories. This means that the average American engineer will usually not attain the specialized scientific heights of the European, but he will have a broader knowledge of the entire engineering field and will be more able to apply his knowledge to the production arts.

"Which system is better? Probably the ideal is some compromise or combination of both, since the ultimate objective is two-fold: to further man's knowledge, and to apply that knowledge for man's benefit. Achieving such a compromise is the most basic reason for continued close scientific liaison between American and European agencies, institutions and people."

DR. GREGORY K. HARTMANN
Technical Director
U. S. Naval Ordnance Laboratory

F. D. LEAMER
Personnel Director
Bell Telephone Laboratories, Inc.

"We employ many engineers . . .

who have obtained their training in Europe. However, any direct comparison between these men and those trained in the United States would be misleading, as the value of an engineer to our organization depends on many factors in addition to his training. A few such factors which should be considered in any fair evaluation are creative ability, intelligence, aptitudes and motivation. These are often not related directly to the part of the globe in which formal training was received."

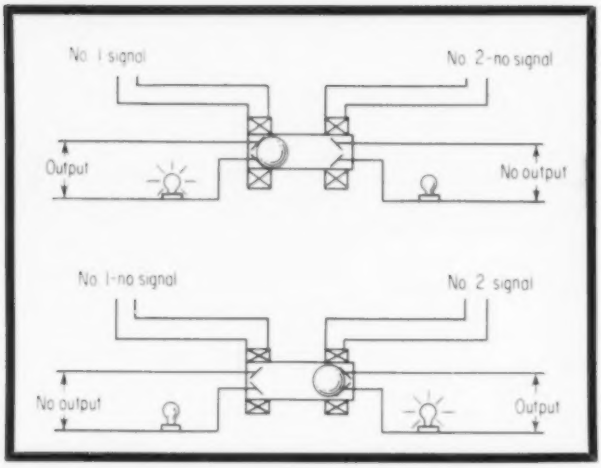
"European and American engineers . . .

in the plastics field are substantially equal in training and ability. My experience in ISO/TC-61 (International Standards Organization, Technical Committee on Plastics) has permitted me to work with engineers from 14 European countries over a period of the last four years. European engineers have generally excellent technical backgrounds in chemical, electrical and mechanical engineering. Many of them have successfully applied their training in the field of industrial plastics.

"Some of the more outstanding work in the development of thermoplastic resins has been done in Europe, while some of the distinguished work in developing thermosetting resins has been achieved here.

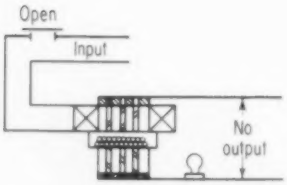
"More mechanical applications for plastics have been developed by US engineers, whereas European engineers have developed greater use of plastics in the field of electric power generation and transmission, reflecting the demand for power applications in Europe as against greater mechanical requirements in America."

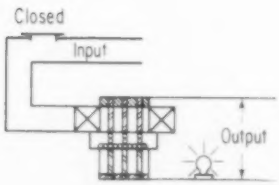
DR. NORMAN A. SKOW
Director of Research
Synthane Corp., Oaks, Penna.

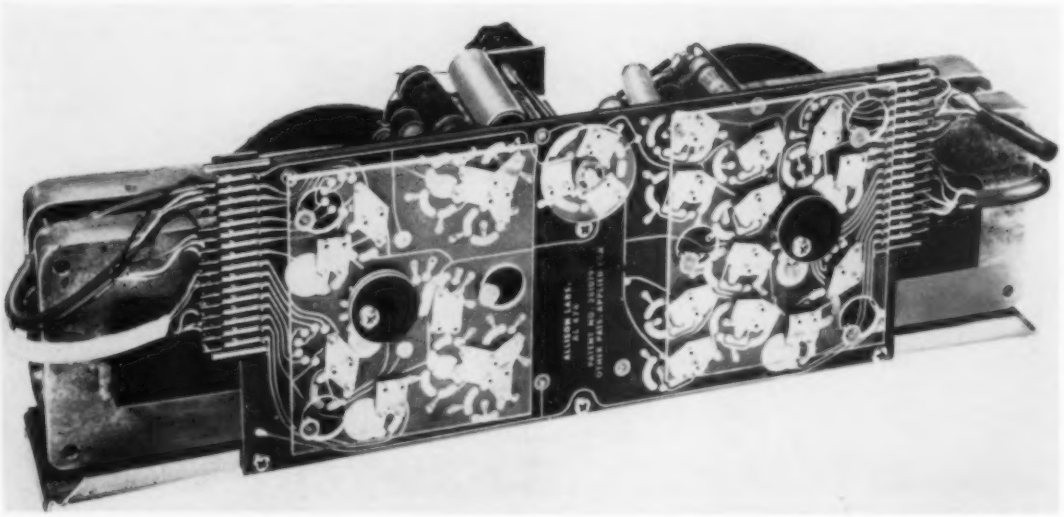


Magnetic-ball relays . . .

handle one or more circuits. De-energized ball, rests on bottom of contact chamber; current or magnetic field causes flux lines to thread ball and pull it up against stationary contacts. In multiple-ball units, energized balls form rigid strings between contacts. Because ball represents infinite number of contact surfaces, wear is greatly retarded, and bounce, chatter and arcing are reduced. Optimum number of balls for general-purpose relays is set at 17, and ball diameter at 0.2532 in. Most promising plating materials for ferrous balls (for min contact resistance) are silver cadmium oxide, rhodium, palladium, platinum. Prices are in line with mechanical limit switches and relays on the market. Volume production is not expected till April-May. Delivery then will be from stock to 2 wk. **Congress Controls, Div. Tann Corp., 3750 E. Outer Drive, Detroit 34.**

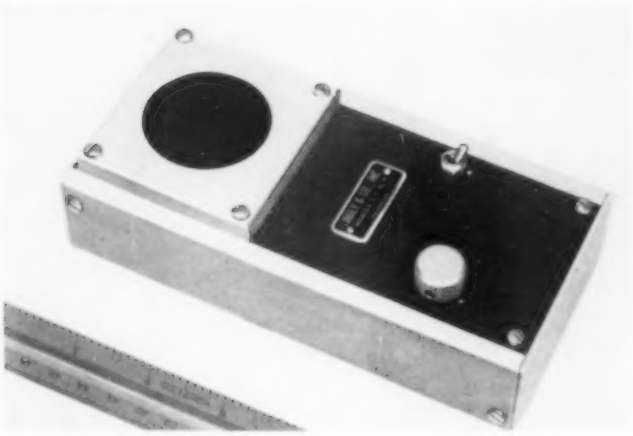






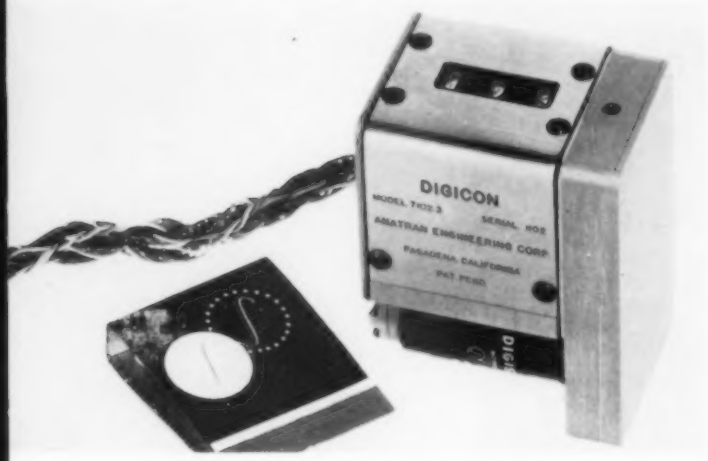
Rotating scanning plate . . .

integrates switching into printed circuits. Plate carries contacts that engage segmented circles located according to specific circuit requirements. By integrating switch mechanism into a printed-circuit board, soldered connections are said to have been reduced up to 80%, with resultant decrease in wiring errors. Device is expected to make possible use of printed circuits in a variety of multi-circuit, multi-switch systems. Units are said to be generally less costly than traditional circuit-switch systems. Delivery 2-3 mo after determination of individual specifications. **Hartsall Co., Dept. E, Div. Allison Laboratories, Inc., 14185 E. Skyline Dr., La Puente, Calif.**



Transistor-equipped infrared detector . . .
produces an audible signal whenever subjected to infrared radiation of the order of micromicrowatts. Available in focused-beam or wide-angle version. Modified, it serves as a voice receiver for amplitude-modulated infrared beams for communication secrecy. Threshhold of instrument must be set for operation in varying degrees of ambient radiation. Self-contained dry-cell power unit provides mo of continuous operation. Uses include industrial applications involving movement and control of materials that emit infrared. Smaller than this pocket-size unit and 115-v models are available. Prototype models are now available at $250; production models will be about $100. 6-wk delivery. **Lindly Co., Mineola, N. Y.**

Rods and tubes of rolled reinforced plastic . . .
are said to provide axial compressive strength of 76,000 psi. Tubes have been produced capable of withstanding 10,000 psi external pressure at 300 F. Resins include epoxies, polyesters, phenolics and diallyl phthalate. Reinforcements may be glass, cotton, Dacron, nylon, Orlon or paper. Diameters up to 8 in. are made in any wall thickness. Prices start at $4; up to 8-ft. lengths available in 2-6 wk; to 40 ft. in 6-8 wk. **Plasteco, Inc., P. O. Box 9123, Houston.**



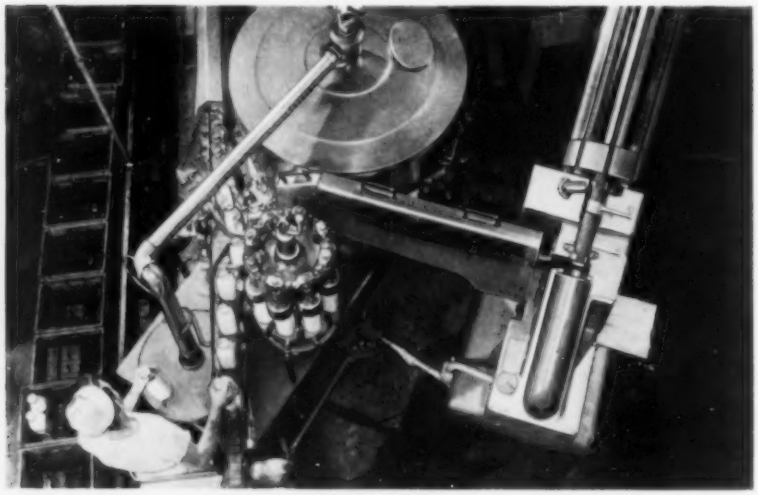
Counter with electrical and visual readout . . .
is bi-directional, with either potentiometers or contacts opposite each wheel. It totalizes positive or negative pulses. Continuous-voltage outputs from each number wheel are proportional to the number indicated in the counter window. Three or five decades of contact closures representing number shown on count wheels can operate printers, punches, recorders. Size, 1.75 x 3 x 3 in. Prices from $620 to $700; delivery, stock to 6 wk. **Digitran Co., 45 W. Union St., Pasadena, Calif.**

One or two-way counters add, subtract and . . .
function as summation counters of impulses. They are said to have a life span exceeding 10 million counts. Counting rates range from 15 to 40 counts per sec. Counter can be supplied in a variety of circuits. Prices range from $120 to $1800, depending on unit and quantity. About 1 mo delivery. **Digitac, Inc., 420 S. Beverly Dr., Beverly Hills, Calif.**

Rubatex Rings withstand 15″ to 19″ of vacuum during 8-hour periods—150 strokes a minute

Rolls of nestled milk caps placed in feed mechanism of American Seal-Kap's automatic Seal-Hooder are separated by a selector head timed to the capping operation.

A RUBATEX CLOSED CELLULAR RUBBER ring on selector head holds one cap at a time under vacuum. Because caps have a series of ridges on top, rubber ring must be soft enough to give or recede under rolls, yet sustain vacuum sufficient to pull cap away from next cap in roll. The vacuum holds cap to selector head until released by a timing device. This operation must be instantaneous and a rubber ring must meet rigid requirements.



Specification: RUBATEX CLOSED CELLULAR RUBBER (G-209-C stock ASTM-R-41) is specified material for selector head rings because its closed cellular structure gives it required softness PLUS excellent recovery properties so that rings will not collapse under 15″ to 19″ of vacuum during periods of 8 hours at speeds reaching 150 strokes per minute.

One of 27
RUBATEX
CLOSED CELLULAR RUBBER STOCKS on the job . . .

RUBATEX DIVISION, Dept. PR-7
GREAT AMERICAN INDUSTRIES, INC.
Bedford, Virginia

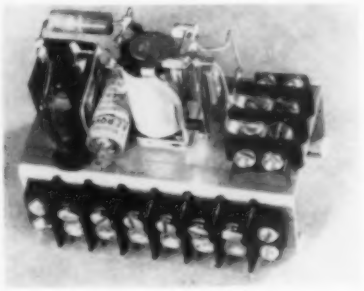
PIONEER MANUFACTURER OF CLOSED CELLULAR RUBBER

For full details and sample board—print your name in space below, attach to your company letterhead and mail to us.

Name _____

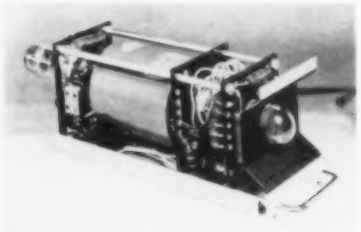
If you want more information about Rubatex, fill in and mail today.

SIGNIFICANT PARTS MATERIALS EQUIPMENT . . .



Phase-sequence switch . . .

is an automatic control device to prevent damage to polyphase electrical equipment connected to the line in the wrong phase sequence. Can shut off interconnected equipment, sound an alarm, reverse phase connections, perform any other switching, control or alarm function desired or perform opposite switching functions. Unit has open-chassis construction with over-all dimensions of 1¾ x 3¾ x 2¾ in. It can be built into a case, another piece of equipment, or can be used separately as auxiliary equipment. Basically designed for use with 50-to-60-cps equipment, it can be modified for 400-cps service. Price is $34.75. **Associated Research, Inc., 3777 W. Belmont Ave., Chicago 18.**



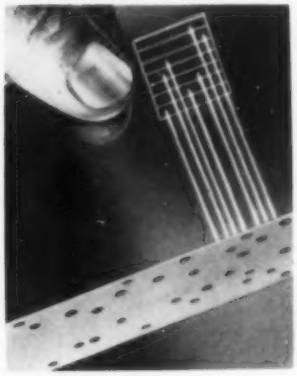
1-mc decade counter . . .

with multiple-digit readout tube resets from any position to zero in less than 1 microsec. The plug-in unit is a companion unit to two decade counters with counting rates of 10 kc and 100 kc. It counts and resets at high speed while making all 10 outputs available for printout or other general-purpose applications. Power requirements are 300 v to 30 milliamp dc and 6.3 v to 0.9 amp ac. In-line figures are visible 30 to 40 ft. **Burroughs Electronic Tube Div., North Plainfield, N. J.**

Liquid epoxy resins . . .

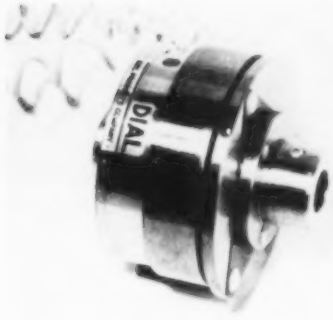
include one said to be water-clear, uniform and that has very low viscosity—characteristics not previously attained with epoxies. Two others are a standard unmodified

resin for customary use in tooling, casting, adhesives and electrical encapsulating and a modified low-viscosity resin said to be well suited for laminating. Prices on the new products are in line with those prevailing in the industry. **Dow Chemical Co., Midland, Mich.**



Silicone rubbers . . .

with improved resistance to compression set at high temperatures are being offered in pilot-plant quantities. Available are three different stocks that produce 60, 70 and 80 durometer, Shore A hardness scale. All three have a serviceable temperature range from —70 to 500 F. Developed for use as oil seals, gaskets, O-rings and similar applications involving extra-high temperatures and high or constant pressures. Compounds are shipped to fabricators in uncatalyzed form. **Dow Corning Corp. Midland, Mich.**



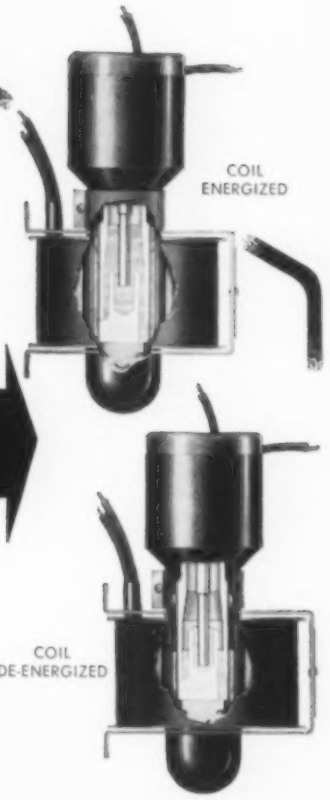
Miniature electromagnetic clutch . . .

has a stationary armature that eliminates slip rings and brushes. A flexible-membrane pole-shoe assembly is said to provide a torsionally rigid unit having zero backlash and zero residual drag. Angular misalignment up to 3° is possible between driving and driven shafts. Dimensions are 1⅛ x 1⅛ in.; clutch delivers a min torque of 7 in.-lb at full power. Power consumption is under 4 w. **Dial Products Co., 9 Ave. E, Bayonne, N. J.**

The
TIMER RELAY
that handles all controlled timing problems . . .

★ No false contacts
★ Non sticking
★ Practically "fail safe"
★ Low cost timer

Durakool®
STEEL MERCURY TIMERS



This steel clad, factory set, tamper proof Durakool timer-relay is practically non-breakable. Operating life multiplied 5 to 6 times by new plunger construction features. Combinations of operate-release time delays from 0.15 sec. to 20 sec.—either normally open or normally closed action.

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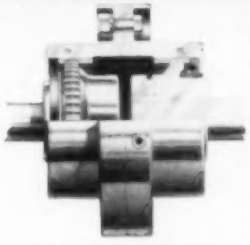
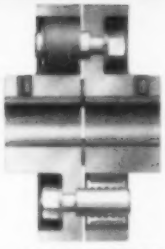


AJAX DIHEDRAL COUPLINGS

AJAX Patented Dihedral tooth shape handles angular and offset misalignment up to 12 degrees.



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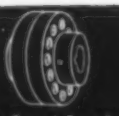
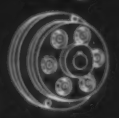
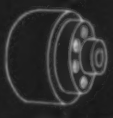
Also manufacturers of Ajax vibrating conveyors, screens and packers.

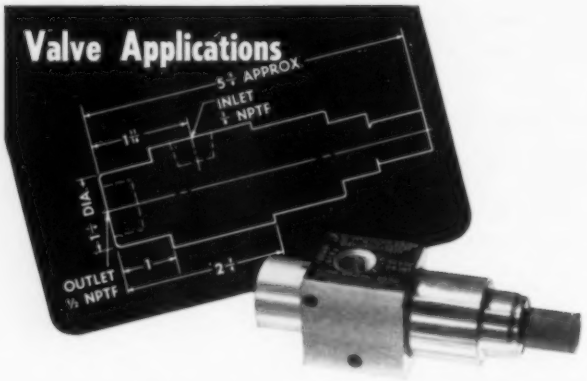

Ajax Type A Semi-Steel and Type S Forged Steel Couplings


Ajax Type SP Shear Pin Coupling

Ajax Type BO Bolt-On Coupling

Ajax Type M Mill Motor Coupling


Ajax Type BD Brake Drum Coupling



Here is a high flow, low pressure fuel valve which handles 560 pounds per hour of fuel flow at an inlet pressure of 30 psi. with a 1 psi. pressure drop. Another example of the versatile family of electro-mechanical devices developed and precision produced by Koontz-Wagner, this valve operates in a -65° to 250° F. ambient range at 17 to 30 volts DC. Special application valves, solenoids and switches designed, developed and produced by Koontz-Wagner may have the answer to your problem. Write now to:

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KOONTZ WAGNER ELECTRIC COMPANY INCORPORATED

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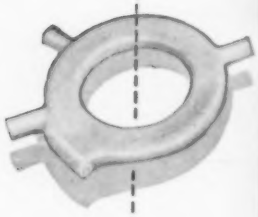

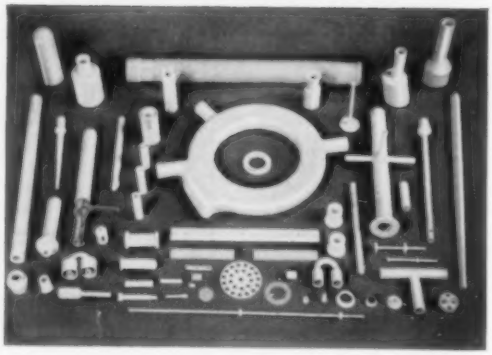

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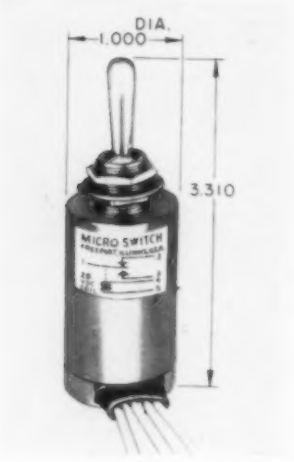
SIGNIFICANT PARTS MATERIALS EQUIPMENT . . .



Magnetic hold-in switch . . .

is composed of a SPDT switching unit and a 28-v-dc solenoid in a 1-in.-dia environment-proof case. When the toggle lever is operated and the solenoid energized, solenoid holds the lever in operated position. This permits remote electrical release of the lever. An elastomer seal at the base of the toggle lever keeps out dust and moisture. Switch may be wired normally open, normally closed or double-throw. Rated at 4 amp, 28 v dc, resistive load. Available with either wire leads or side-facing screw terminals. **Micro Switch, Div. of Minneapolis-Honeywell Regulator Co., Freeport, Ill.**

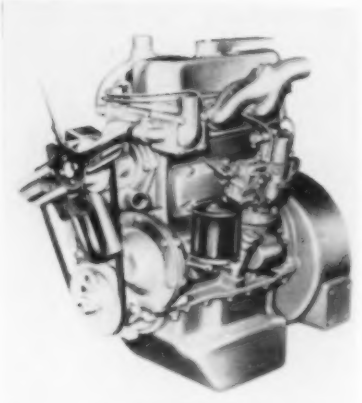
Heat-resistant glass cloth . . .

has been pre-impregnated with phenolic resin for high-temperature applications. It shows 59,000-psi flexural strength at 500 F after 100 hr exposure, and 80,000-psi flexural strength at room temperature. Material retains flexibility and tack for more than 1 yr. Supplied in various degrees of resin content, drape and tack for low and high-pressure molding. Standard rolls are ready for immediate use without preliminary operations. Laminates are primarily for aircraft, missile and other critical applications. **Standard Insulation Co., East Rutherford, N. J.**

Photo-voltaic cells . . .

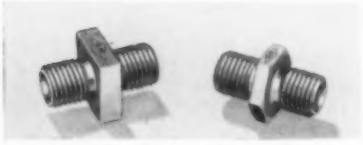
for use in photoelectric devices requiring fast response, max light sensitivity and low cost. Silicon cells operate through temperature variations from —85 to 347 F and higher, with a spectral-response range from 3,000 to over 10,000 Angstroms. Applications include punched-tape and

card readouts, programming controls, pinhole detection, remote switching controls, infrared sensing, automatic counting. **Hoffman Electronics Corp., Semiconductor Div., 930 Pitner Ave., Evanston, Ill.**



Convertible 3-cyl engines . . .

gasoline and diesel models, are notable for their interchangeability as units and extensive interchangeability of parts. Through extensive use of common components, it is possible to change an engine built as a gasoline unit into diesel type and vice versa. Direct injection, open-combustion principle of converting fuel to energy is used in both types, with overhead valve arrangements. Both engines are based on the use of same cylinder blocks, crankshafts, connecting rods, oil pans and front and rear ends of engines of like size. Gasoline engines in bores of 3½, 3¾ and 4 in. have ratings of 39, 45 and 51 hp at 2400 rpm, respectively. Diesel engines with bores of 3½, 3¾ and 4 in. have ratings of 34, 38 and 44 hp at 2000 rpm, respectively. Each has four main bearings. Engines have displacements of 130, 149 and 169 cu in. **Hercules Motors Corp., 101 Eleventh St., S. E., Canton, Ohio.**



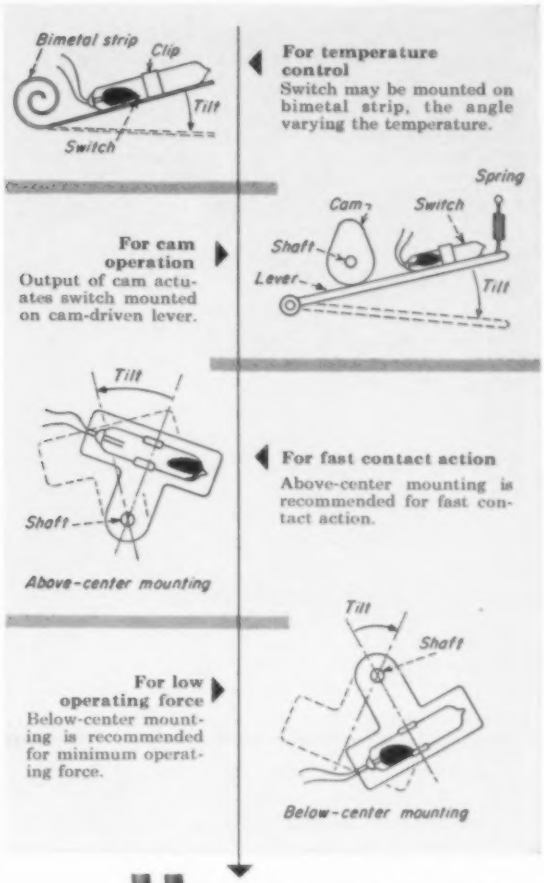
Miniature relief valve . . .

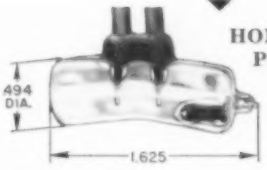
is set for pressures from 1000 to 4100 psi. Rated flow at set pressure is 0.25 gpm. Reseats at 90% of set pressure. There are no seals or packings. Made in tube size 4. For applications where cracking-pressure adjustments are not required. Medium, compatible, with 18-8 and 440F stainless can be used. Operates in temperatures from −65 to 400 F. MS 33514 flareless tube connections are standard. **Republic Mfg. Co., 15655 Brookpark Rd., Cleveland 11.**

H MICRO SWITCH Precision Switches

4 ways HONEYWELL Mercury Switches are used in modern design applications

HONEYWELL Mercury Switches include over 1000 variations to meet individual needs. MICRO SWITCH field engineers provide special help with mounting methods, actuating linkages and shock-proof enclosures. HONEYWELL Mercury Switches are ideal for locations where dust, fumes, spray or splash are present.





HONEYWELL Mercury Pulse Switch for slow rotating devices

This switch has proved exceedingly useful for direct one-to-one counting on slow rotating devices. Pulse action is accomplished by the curved glass tube. These include business machines, timing devices, vending machines, signaling devices, etc.

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NEW LITERATURE

Better Report Writing

W. H. Waldo, *Monsanto Chemical Co. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22. 5¼x7¾, 231 pp. $4.75.*

There is another freedom of the press worth fighting for: freedom from ambiguity, dullness, jargon, illiteracy. These are notorious faults of much technical writing, and any book that combats them is welcome.

This little book by a technical editor at Monsanto is intended as a handy desk guide for the technical author. Three of the seven chapters, including one called "Emphasis on Empathy," directly concern report-writing. The remainder (including a chapter contributed by G. G. Hawley, executive editor of the Reinhold Book Div.) lead the reader helpfully through the customary problems in how-to-write—sentence structure, punctuation, clarity, emphasis, etc. The book offers no trick solutions: Concerning "fog indexes," for example, it says there is no "mysterious virtue in having sentences average some special number of words." What is one of the worst vices of technical writing? Mr. Waldo feels it is "the habitual use of abstract terms like *cases* and *instances* for concrete, clearly significant terms that can be easily understood." The exposition is aided by working examples, with special attention to the vocabulary of the chemist.

At end of the book are three appendixes. First is "Journal Title Word Abbreviations"; next is a 5-page list of compound words from the US G.P.O. *Style Manual*; third is a 7-page list of abbreviations and symbols—a composite prepared from four sources. The book is also helpful as a bibliography. It has searched the literature well and gives 209 references to previously published books and papers on better writing. WG

Management for Engineers

Roger C. Heimer, *assoc. prof. of M.E., Villanova U., Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36. 6x9 453 pp., $6.75.*

This is both a school text and a working-engineer's handbook. The author, who received his B.S.M.E. from the Coast Guard Academy in 1918, retired from the Navy as a rear admiral in 1946, and got his B.S. from Gettysburg in the same year. He received an M.A. from the U. of Penna. in 1948, has lectured there and spent five years as a representative of the N. Y. Stock Exchange. Thus his background is quite broad.

The author gives as his reason for the book: "40% of all professional engineers eventually become managers." (Don't miss in this that word "professional"—it's important.) The book provides chapters on legal forms, money flow, interest and time, production costs, power and light, insurance, depreciation, inventory, standards, labor and equipment costs, budgets, organization, communication, and decisions.

This is no theoretical text; the information is factual and basic bibliographies are included for supplementary reading. The author is strongly in favor of professional registration, so "engineer" is always accompanied by "professional" in the text. There is, as the initial summary indicates, little on design and development engineering beyond generalities—but then this is a management book. EJT

New Technology Solid-state Physics

Abstracted from "A New Technology—Solid-state Physics," by Michael Ference, Jr. Ford Motor Co., SAE paper 23B, 486 Lexington Ave., New York 17.

This paper was read before the recent SAE annual meeting in Detroit, to familiarize automotive-industries technical personnel with the scope, activities, achievements, and potential of solid-state physics. Among topics discussed were: Intrinsic properties of solids; semiconductors; surface phenomena; superconductivity; magnetic resonance and masers; photoconductive, luminescent and electroluminescent materials.

The Economic Almanac—1958

Published by Thomas Y. Crowell Co., 432 4th Ave., New York City. 5½x8¼, 673 pp. $5.

This annual brings together figures on mineral resources, population, industrial production, prices, and other essential facts from many sources. It can aid product development by spotlighting growing (and shrinking) sources and markets.

REMOTE AREA MONITORING SYSTEMS—Bulletin 3045A, 4 pp. Describes basic units in the systems and gives specification data such as ranges, response, accuracy and stability. Model numbers, applications, dimensions and weights are included. Victoreen Instrument Co., 5806 Hough Ave., Cleveland 3.

PHENOLIC RESINS—Brochure CDC 344, 12 pp. Describes line of phenolic resins, varnishes and molding powders. Includes technical data, special properties and product features. Useful reference in specifying proper materials for applications. Illustrated with application photos. General Electric Co., 1 Plastics Ave., Pittsfield, Mass.

PRINTED CIRCUITRY—File Folder. Contains descriptive data on materials, specs, design tolerances, applications, process for plating holes. Printed Electronics Corp., North St., Natick, Mass.

PHOTODRAWINGS—Booklet P-22, 12 pp. Describes technique of using photos to convey engineering drawing information. Included are sections on making picture negatives, equipment and materials needed, making master photodrawing, direct-process reproduction, halftone methods, continuous-tone and composite methods, blueprint and lithographic reproduction. Eastman Kodak Co., Rochester, N. Y.

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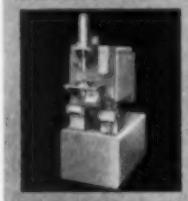

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Publisher's Postscript...

STAND TALL

—and see abroad

Sputniks and other events point to the importance of looking around us for ideas—outside the United States as well as within. The successful designer must "stand tall", and see what others are doing.

Our editors have felt the need for data on overseas design work for many years. They have combed foreign sources for new ideas just as they checked domestic ones, and have brought you what they felt would be of help.

This service was amplified when we began weekly publication. Last year, for example, we published almost 200 items from some 39 foreign countries, ranging from single paragraphs to several pages in length. The total was almost 150 pages, a bit over half in the design edition, 23 pages in the annual Design Digest, and the remainder in the four months of the R & D Edition. England and Germany were our largest sources last year, followed by Canada, France, Italy, Sweden and Russia. There will be more this year, because we have added five editors of our own to the worldwide McGraw-Hill News Bureau service. They work out of London, Paris, Bonn, Zurich and Milan. Most of them are engineers, so they can select from a great deal of material that which will be most valuable to you.

This coverage of foreign ideas is added to the domestic work of our own large staff, including regional editors in Washington, Detroit and Los Angeles. And editors working out of New York are also scouring the country for new concepts which you can adopt or adapt.

Our objective is simple—to provide you with all the information you need, from whatever source, to "stand tall" among design engineers.

—AH

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74 for Your Information (personal)

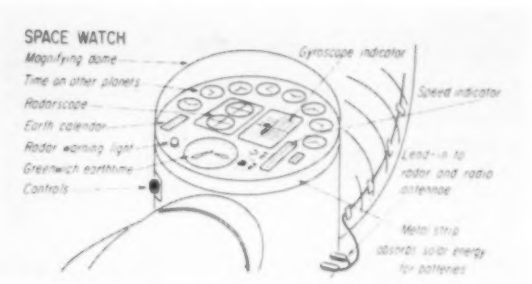
Through the wall for comfort

A big brother is joining the family of home air conditioners. It's inserted through the wall instead of window. It works through the warm air furnace. And it conditions the entire house—not just a room or two. Frigidaire is introducing the packaged unit this spring.

It's said to install as easily and cheaply as a room unit. Just poke it through the wall so one end faces outdoors and the other hooks up with the furnace plenum. The unit—condenser and cooling coil—weighs under 350 lb.

There will be two models: 24,000 and 35,000 btu (2 and 3 ton). Installed cost is expected to "30% to 50% lower than conventional equipment of comparable cooling capacity."

Timing the space traveler



We don't know when it will be available; neither do Girard Perregaux engineers. But they can dream, can't they? Here's their dome-shaped cylindrical design for a Space Watch, based on a suggestion by Dr. Lloyd Motz, Columbia University professor of astronomy and physics. It would be powered by solar energy; and sport a gyroscope direction-finder, and a radar indicator (to warn of approaching meteors).

The idea has a practical twist, though. It's a publicity tie-in with GP's introduction of its forward-looking 1958 automatic wrist watch. This watch, handsome and practical, features the new Gyrotron 39-jewel movement (*PE*—Dec. 9, p 12). Called the Gyromatic, it's now in retail stores ($125 to $1500).

How the camera helps

Photodrawings—blueprints on pictures—are described in a 12-page booklet from Eastman Kodak Company. It tells how to reproduce product pictures on translucent material, and how best to superimpose sketches and detail information. Free copies of the booklet may be had from Sales Service Div., Eastman Kodak Co., Rochester, N.Y.

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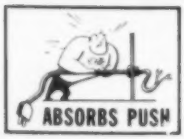

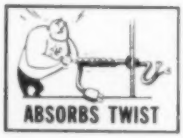

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—H. J. Brikowski

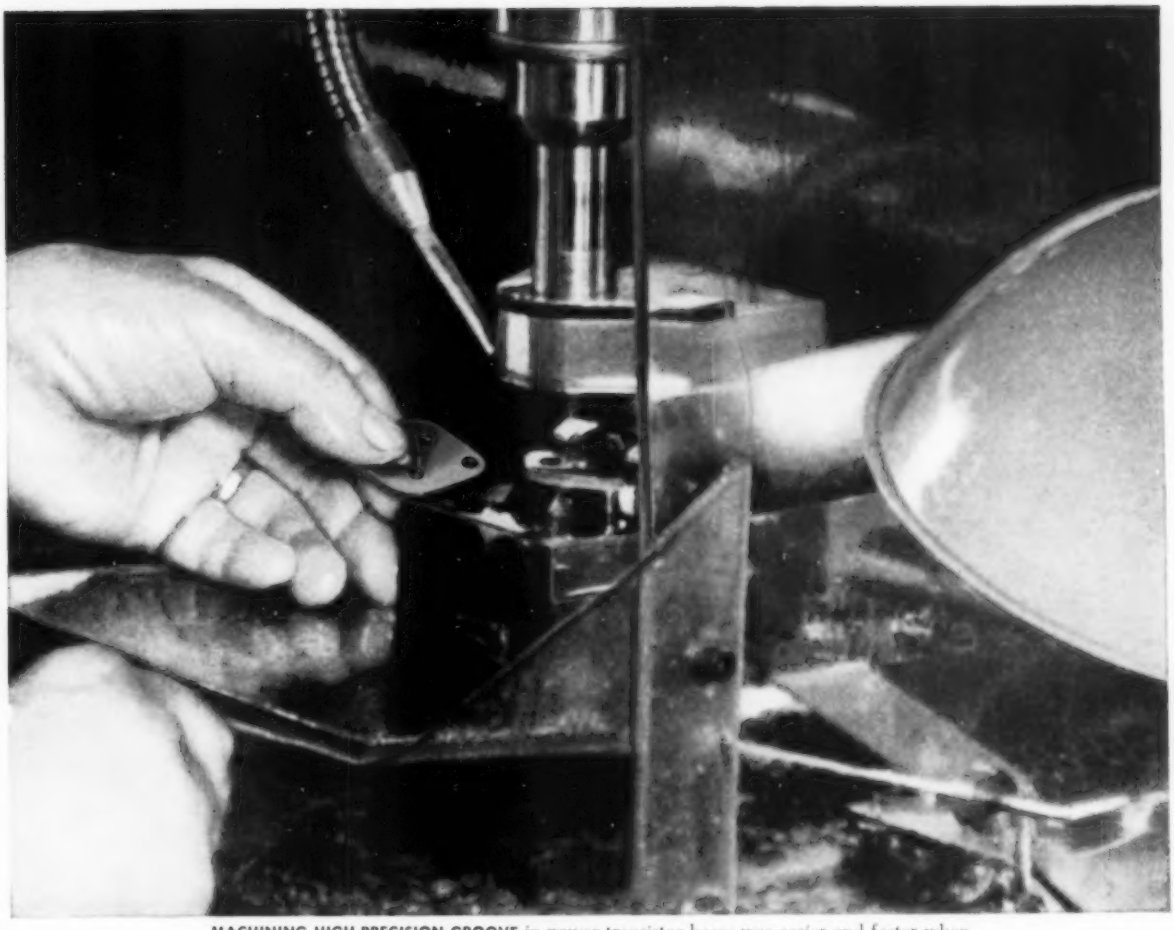
. . . radio-controlled door lock which would eliminate need for keys. This control could be adjusted to lock or unlock any door in the house from any reasonable point in or near the house by setting a different frequency on each door. Picking locks would be a thing of the past. —R. Danbrowney

. . . an unbreakable dispenser for powdered detergents. It would be similar to the sugar dispensers in many restaurants. Just tip and get one teaspoonful—for kitchen, bathroom, workshop and garage. —K. Kahn

. . . an inexpensive kit for converting an ac bathroom wall socket to dc for electric shavers. The kit should be inexpensive, easily installed by even the non-electrical minded, and should have one of the two outlets untouched for use with other ac household appliances.—T. N. Tyler

. . . a potting compound for encapsulating electrical assemblies that could be removed later without melting or breaking the parts? This would not have to be an easy removal, but in test work, it is often necessary to disassemble to find out what failed and why. It would also come in handy where emergency repair is involved and full replacement is not available. —J. Meyer

Have you a pet project but neither the time nor inclination to do the necessary R & D–Product Engineering will welcome (and pay $10 each for) similar ideas based on known scientific principles but lacking an inspired manufacturer



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